Final

Supplemental Environmental Impact Statement

Guam and Commonwealth of the Northern Mariana Islands Military Relocation (2012 Roadmap Adjustments)

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Joint Guam Program Office
Washington, DC

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July 2015

Report Documentation Page

Form Approved
OMB No. 0704-0188

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1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
28 AUG 2015	**Environmental Impact Statement**	**00-00-2010 to 00-00-2015**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Final Supplemental Environmental Impact Statement Guam and Commonwealth of the Northern Mariana Islands Military Relocation (2012 Roadmap Adjustments)	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **United States Navy,Guam and Commonwealth of the Northern Mariana Islands,Yigo,GU,96929**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
Final Supplemental Environmental Impact Statement Guam and Commonwealth of the Northern Mariana Islands Military Relocation (2012 Roadmap Adjustments)

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**1624**	

DEPARTMENT OF DEFENSE

Department of the Navy

Record of Decision for the Final Supplemental Environmental Impact Statement for Guam and Commonwealth of the Northern Mariana Islands Military Relocation

AGENCY: Department of the Navy, Department of Defense

ACTION: Record of Decision

SUMMARY: The Department of the Navy (DON), after carefully considering the environmental consequences of the proposed action, as well as strategic, operational, and training requirements, obligations under treaties and other international agreements, and cost, announces its decision to construct and operate a main base (cantonment area), a family housing area, a live-fire training range complex (LFTRC), and associated infrastructure on Guam to support the relocation of a substantially reduced number of Marines and dependents than previously analyzed in a 2010 Final Environmental Impact Statement (EIS) (*Guam and Commonwealth of the Northern Mariana Islands (CNMI) Military Relocation; Relocating Marines from Okinawa, Visiting Aircraft Carrier Berthing, and Army Air and Missile Defense Task Force*). The DON has selected the preferred alternative as identified in the 2015 Final Supplemental Environmental Impact Statement (SEIS), consisting of a cantonment at Naval Computer and Telecommunications Station Finegayan (Finegayan) and family housing at Andersen Air Force Base (AAFB) (Alternative E in the 2015 Final SEIS), and a LFTRC at AAFB–Northwest Field (NWF) (Alternative 5 in the 2015 Final SEIS). The LFTRC also includes a stand-alone hand grenade range at Andersen South. Under Alternatives E and 5, the DON will be able to meet current and future DON and Department of Defense (DoD) training and operational requirements.

This Record of Decision (ROD) documents why the DoD has chosen to implement the preferred alternatives as described in the 2015 Final SEIS. The ROD includes descriptions and discussions of the anticipated environmental impacts of the proposed action. It also includes descriptions and discussions of all related actions and their anticipated impacts.

The selected cantonment/family housing Alternative E comprises approximately 1,751 acres (709 hectares [ha]) of land (not including offsite utility corridor improvements which total approximately 150 acres [60 ha]) that are currently under the custody and control of the DoD. The selected LFTRC Alternative 5 at AAFB-NWF includes a construction footprint area of approximately 338 acres (137 ha) plus an additional 3,701 acres (1,498 ha) of land and submerged land for surface danger zones (SDZs). The entire LFTRC Alternative 5 construction footprint is currently under the custody and control of the federal government. Although the selected alternative does not require acquisition of non-federal land on Guam, access restrictions already established by the U.S. Fish and Wildlife Service (USFWS) at the Ritidian Unit of the Guam National Wildlife Refuge (NWR) (which is managed by the USFWS) may be adjusted to account for the establishment of the SDZs for the LFTRC once it is operational. In accordance with the provisions of section 2822 of the National Defense Authorization Act (NDAA) for the fiscal year (FY) 2015 (Pub. L. No. 113–291), the DON will pursue an agreement with the USFWS to establish and operate a SDZ associated with LFTRC Alternative 5 that will allow for the continued management of and access to the Ritidian Unit consistent with the purposes for which it was established.

This decision adopts all of the mitigation measures that were identified in the 2015 Final SEIS to avoid or minimize adverse environmental impacts from the preferred alternatives with the exception of proposed

mitigation to designate an Ecological Reserve Area (ERA) on Naval Munition Site (NAVMAG) and for the expansion of Orote Peninsula ERA. The ERA on NAVMAG and Orote Peninsula ERA expansion were proposed to mitigate for loss of native habitat from direct and indirect impacts of the preferred alternatives. To mitigate for loss of recovery habitat for the endangered Guam Micronesian kingfisher, the DON and the USFWS entered into a Memorandum of Agreement (MOA) on June 11, 2015, which commits the DON to designate approximately 5,324 acres under the custody and control of the DoD in northern Guam to a status that will provide durable habitat protection needed to support recovery habitat and land management for the survival and recovery of the species. This designation and management commitment, together with other MOA provisions, the conservation measures and best management practices identified in the Final SEIS, and the terms and conditions in July 31, 2015 Biological Opinion issued by the USFWS, adequately mitigate for impacts to recovery habitat for the Guam Micronesian kingfisher resulting from implementation of the selected alternatives. This ROD was prepared in accordance with Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (NEPA), 40 Code of Federal Regulations (CFR) §§ 1500–1508, and specifically, 40 CFR § 1505.2 ("Record of decision in cases requiring environmental impact statements").

FOR FURTHER INFORMATION CONTACT: Director, Joint Guam Program Office Forward, P.O. Box 153246, Santa Rita, Guam 96915.

SUPPLEMENTARY INFORMATION: Pursuant to 42 United States Code (U.S.C.) §§ 4321 *et seq*. (section 101 *et seq*. of NEPA), the regulations of the CEQ that implement NEPA procedures (40 CFR §§1500–1508), and applicable DoD and DON environmental regulations and instructions that implement these laws and regulations, the DON announces its decision to construct and operate a cantonment, family housing, a LFTRC, and associated infrastructure on Guam to support the relocation of a reconfigured and substantially reduced U.S. Marine Corps force to Guam than originally was addressed in the 2010 Final ROD. This decision will enable the DON to: (1) ensure that the relocated Marines are organized, trained, and equipped as mandated by 10 U.S.C. § 5063; (2) satisfy individual live-fire training requirements as described in the 2015 Final SEIS; and (3) establish an operational Marine Corps presence on Guam in accordance with the April 27, 2012, joint statement issued by the U.S.-Japan Security Consultative Committee (hereinafter the "2012 Roadmap Adjustments").

BACKGROUND: On September 30, 2010, the DON signed a ROD (77 Federal Register [FR] 60438) regarding the 2010 Final EIS for the *Guam and Commonwealth of the Northern Mariana Islands (CNMI) Military Relocation; Relocating Marines from Okinawa, Visiting Aircraft Carrier Berthing, and Army Air and Missile Defense Task Force*. The 2010 ROD documented, in pertinent part, the DON's decision to implement the preferred alternatives identified for the main cantonment area, aviation, and waterfront operations to support relocation of approximately 8,600 Marines and approximately 9,000 dependents to Guam. The 2010 ROD deferred a decision on the specific site for a LFTRC pending completion of the section 106 consultation process under the National Historic Preservation Act (NHPA) (16 U.S.C. § 470 *et seq.*). In March 2011, subsequent to issuance of the 2010 ROD, the DoD executed the *Programmatic Agreement among the Department of Defense, the Advisory Council on Historic Preservation, the Guam State Historic Preservation Officer, and the Commonwealth of the Northern Mariana Islands State Historic Preservation Officer Regarding the Military relocation to the Islands of Guam and Tinian* (2011 Programmatic Agreement [PA]). The 2011 PA was developed in consultation with the Guam and CNMI State Historic Preservation Offices (SHPO), the Advisory Council on Historic Preservation (ACHP), the National Park Service (NPS), other federal and Guam and CNMI agencies, and the public.

On February 7, 2011, the Undersecretary of the Navy sent a letter to the Governor of Guam reiterating the 4-pillars that would guide DoD's approach to the military buildup. The DON remains committed to the 4-pillars. Relative to the analysis in the 2015 Final SEIS, one of the pillars was a commitment to provide 24 hour a day, 7 days a week access to the Pågat Village and Pågat Cave historical sites, to include the existing trail. Having deferred a decision on the location for the LFTRC along Route 15, the DON subsequently applied a probabilistic methodology to more precisely model the size of the SDZ associated with the Multi-Purpose Machine Gun (MPMG) Range that will be part of the LFTRC. Application of this methodology reduced the size of the overall footprint and enabled the DON to reevaluate potential LFTRC locations on Guam, including those locations previously considered but not carried forward for detailed analysis. This reevaluation resulted in the identification of additional LFTRC preliminary alternatives. In light of this information, the DON initially elected to prepare a SEIS limited solely to the evaluation of potential impacts associated with the construction and operation of a LFTRC on Guam (hereinafter "LFTRC SEIS"). The DON issued a Notice of Intent (NOI) to prepare the LFTRC SEIS on February 9, 2012, (77 FR 6787), and held three public scoping meetings on Guam on March 17, 19, and 20, 2012.

On April 27, 2012, the U.S.-Japan Security Consultative Committee issued a joint statement announcing its decision to adjust the plans outlined in the May 2006 Roadmap for Realignment Implementation. In accordance with these 2012 Roadmap Adjustments, the DoD adopted a new force posture in the Pacific, providing for a materially smaller and reconfigured force on Guam. In conjunction with changes to the mix of personnel involved in the relocation, the force adjustments reduced the originally planned relocation of approximately 8,600 Marines with 9,000 dependents to a force of approximately 5,000 Marines with approximately 1,300 dependents. That decision prompted the DON's review of the actions previously planned for Guam and approved in the 2010 Final ROD. This review concluded that while some actions remained unchanged, others, such as the size and location of the cantonment and family housing areas, could significantly change as a result of the modified force. Therefore, the DON published a new NOI on October 11, 2012, (77 FR 61746), and amended the scope of the ongoing LFTRC SEIS to add those actions that materially changed as a result of the new force posture.

The proposed change in size and composition of the new force structure under the 2012 Roadmap Adjustments and the reconsideration of the LFTRC SDZ footprint did not affect all of the decisions made in the 2010 Final ROD. For example, the location of Aviation Combat Element facilities, the air embarkation facilities (Air Mobility Command Complex), the development of the North Gate and access road at AAFB, the wharf improvements at the Navy base at Apra Harbor, and the non-live fire and maneuver training ranges on Andersen South remain unaffected by the changes in force structure resulting from the 2012 Roadmap Adjustments. For those decisions not affected by the new force structure, the 2010 Final ROD stands as the final agency action. The 2015 Final SEIS and this ROD do not include the transient aircraft carrier berthing in Apra Harbor or the U.S. Army Air and Missile Defense Task Force deployment that were addressed in the 2010 Final EIS. The disposition of those projects is independent of the proposed action analyzed in the 2015 Final SEIS and in this ROD.

PURPOSE AND NEED: The overarching purpose of the proposed action is to meet international agreement and treaty requirements and to fulfill U.S. national security policy requirements to provide mutual defense, deter aggression, and dissuade coercion in the Western Pacific Region. From a global strategic perspective, the U.S. maintains military capabilities in the Western Pacific to support U.S. and regional security, economic, and political interests. The Guam Military Relocation proposes distinct, yet related actions to support this position.

The purpose and need for the proposed action evaluated in the 2015 Final SEIS is to (1) ensure that the relocated Marines are organized, trained, and equipped as mandated by 10 U.S.C. § 5063, (2) satisfy individual live-fire training requirements as described in the 2010 Final EIS, and (3) establish an operational Marine Corps presence on Guam and ensure consistency with the new force posture adopted by the DoD in accordance with the 2012 Roadmap Adjustments.

PUBLIC INVOLVEMENT: On October 11, 2012, the DON published a NOI (77 FR 61746) to prepare a SEIS to evaluate the potential environmental impacts of the construction and operations of a main base (cantonment), family housing, a LFTRC, and associated infrastructure on Guam to support the relocation of a substantially reduced number of Marines and dependents than previously analyzed in a 2010 EIS (*Guam and Commonwealth of the Northern Mariana Islands (CNMI) Military Relocation; Relocating Marines from Okinawa, Visiting Aircraft Carrier Berthing, and Army Air and Missile Defense Task Force)*. This notice included a project description and scoping meeting dates and locations. In addition, a NOI/Notice of Scoping Meetings was distributed concurrently to federal, state, and local elected officials and government agencies, non-governmental organization representatives, and other entities interested in the SEIS. The DON held three public scoping meetings on Guam on November 8, 9, and 10, 2012, which were attended by a total of 241 people. During the 60-day scoping period that concluded on December 10, 2012, the DON received 398 comment letters, including 10 duplicate comments, 131 identical form letters from members of the Community Advocates of the Raceway, and 52 comments from Community Advocates of the Raceway that attached signed petitions (collectively totaling more than13,000 signatures). All topics identified during the scoping period were considered in the development of the scope of the environmental impact analysis.

On April 18, 2014, the U.S. Environmental Protection Agency (EPA) published a Notice of Availability (NOA) for the Draft SEIS (79 FR 21917). Concurrently, DON published a NOA and a Notice of Public Meetings (79 FR 21907) and in Guam newspapers. The Draft SEIS was distributed for public and agency review. The DON's NOA identified locations (e.g., public libraries) where the Draft SEIS was available for review, the duration of the public review and comment period, the available options for submitting comments, and the time and location of three scheduled public information meetings and public hearings on Guam.

The DON held three open-house style meetings combined with three public hearings to both inform the public about the proposed action and identified impacts and to receive written and verbal feedback about the Draft SEIS from the public. Informational posters were displayed, fact sheets about the project (including one translated into Chamorro) were handed out, and subject matter experts were available during each open house to answer questions on the Draft SEIS. Consistent with the meeting announcements, the DON provided information and supported discussion of how compliance with NHPA will be accomplished through continued implementation of the 2011 PA. Comment forms, a stenographer, and a Chamorro language translator were available during the open house portion of each meeting to receive written and oral comments. Oral comments were recorded during the public hearing portion of each meeting, and transcripts of each hearing are included in the record. The public meetings/hearings took place on Guam on May 17, May 19, and May 20, 2014. Each meeting consisted of an open house, immediately followed by a public hearing.

The public comment period for the Draft SEIS was initially scheduled to last 60 days, with a published end date of June 16, 2014. In response to public comments, the DON extended the public comment period for the Draft SEIS by 15 days to July 1, 2014. The DON received a total of 906 unique comments during the public comment period covering a number of topics.

The EPA published a NOA for the Final SEIS on July 17, 2015 (80 FR 42491). The DON published a NOA for the July 2015 Final SEIS in local newspapers and posted it on the project website (www.guambuildupeis.us). The notice announced the availability of the 2015 Final SEIS and gave an overview of the proposed actions and potential environmental impacts as presented in the document. The DON distributed copies of the 2015 Final SEIS in the same manner as the Draft SEIS (i.e., distributed to libraries on Guam, regulatory agencies, elected officials, and individuals and groups who had requested copies). The DON also mailed post cards announcing the availability of the 2015 Final SEIS to those individuals requesting such notice.

ALTERNATIVES CONSIDERED: NEPA requires the identification, consideration, and analysis of alternatives that contribute to the goal of objective decision making. CEQ's implementing regulations require the decision maker to consider the environmental effects of the proposed action, including a no action alternative to the proposed action (40 CFR § 1502.14). As a result of the reduced acreage requirements for the cantonment and family housing facilities, as well as other factors such as the reconfigured SDZ footprint for the proposed LFTRC, public input, refined range designs and criteria, and a reassessment of operational requirements, conflicts, and opportunities, the DON considered a broad range of siting alternatives in the Draft SEIS. Some of these siting alternatives were not feasible under the conditions evaluated in the 2010 Final EIS but were reconsidered for the 2012 Roadmap Adjustments that launched the SEIS.

Cantonment/Family Housing: The DON analyzed five cantonment/family housing alternatives in the 2015 Final SEIS, all of which are located on land under the custody and control of the DoD.

- Finegayan Cantonment/Family Housing (Alternative A): Alternative A would be completely contained on existing federally owned land. This alternative would be bound on the north by AAFB-NWF, on the east by Route 3, and on the west by a cliff line (within federal property), the Haputo Ecological Reserve, and the Philippine Sea. The site also would be bound to the east by limited residential development and to the south by the Dos Amantes planned area, also known as the former Harmon Village (non-federal property). This alternative would comprise approximately 1,495 acres (605 ha) within one contiguous parcel of land, although the family housing area would be separated from the cantonment core by approximately 1.5 miles (2.4 kilometers [km]).

- Finegayan Cantonment/South Finegayan Family Housing (Alternative B): Alternative B would include approximately 1,450 acres (587 ha) of federally owned land. The cantonment area of this alternative would be in the same location as the proposed cantonment for Alternative A. The family housing area would be located at the South Finegayan site, approximately 1.0 mile (1.6 km) from the southern boundary of Finegayan. The portion of the South Finegayan parcel proposed for development of family housing would cover approximately 290 acres (117 ha).

- AAFB Cantonment/Family Housing (Alternative C): Alternative C would be located on AAFB, which is bound to the north and east by the Pacific Ocean, to the south by privately owned residential areas, and to the west by Route 9 and AAFB-NWF. Alternative C would utilize approximately 1,819 acres (736 ha) of federally owned land. The cantonment/family housing areas of Alternative C would not be contiguous, but both areas would be contained within the same installation fence line. The family housing area for Alternative C would be located at the current AAFB family housing area approximately 2 miles (3.2 km) southeast of the proposed cantonment area.

- Barrigada Cantonment/Family Housing (Alternative D): Alternative D would be located on the eastern side of Guam, with Route 15 bordering the site to the east and south, and Routes 16 and 10 to the west. The northern and southern sections of the Barrigada property are connected by a strip of open space that was the former Nimitz Golf Course. Alternative D would comprise approximately 1,194 acres (483 ha) of federally owned land. The cantonment and family housing areas would be located on one contiguous parcel of land. This is the environmentally preferred alternative for cantonment/family housing.

- Finegayan Cantonment/AAFB Family Housing (Alternative E): Alternative E, the preferred alternative in the 2015 Final SEIS, would consist of a combination of the main cantonment at Finegayan that was previously analyzed in the Draft SEIS under Alternatives A and B, and the family housing at AAFB that was analyzed in the Draft SEIS under Alternative C. Alternative E would comprise approximately 1,723 acres (697 ha) of federally owned land. The cantonment for this alternative would consist of 1,213 acres (491 ha) located at Finegayan. The family housing area for Alternative E would consist of 510 acres (206 ha) located at the current AAFB family housing area.

Live-Fire Training Range Complex: The DON analyzed five alternatives for the LFTRC in the 2015 Final SEIS. As identified in the Final SEIS, the location for the hand grenade range is common to all LFTRC alternatives and is located at Andersen South as identified in the Final SEIS. Working with the Federal Aviation Administration (FAA), establishment of Special Use Airspace (SUA) would be required for each alternative. Configuration of the SUA would be specific to each LFTRC alternative, the determination of which would be made with issuance of this ROD.

- Route 15A (Alternative 1): Alternative 1 would consist of approximately 3,762 acres (1,522 ha) and would require federal land acquisition of an estimated 872 acres (353 ha) of Chamorro Land Trust Commission, Guam Ancestral Lands Commission (GALC), and GovGuam lands. Direct physical disturbance would potentially occur on approximately 383 acres (155 ha) of this site for the construction of the individual ranges, range support building, parking areas, range towers, internal range access roads, a perimeter fence, and the realignment location of Route 15. Approximately 3,379 acres (1,367 ha) would include lands and submerged lands within the SDZ that would not be directly impacted as a result of construction or operation of the LFTRC. This includes approximately 574 acres (232 ha) of GovGuam land and 2,805 acres (1,135 ha) of the submerged lands of the Pacific Ocean.
- NAVMAG (East/West) (Alternative 2): Alternative 2 would consist of approximately 3,815 acres (1,544 ha) (not including the hand grenade range at Andersen South) and would require acquisition of approximately 1,894 acres (766 ha) of privately owned and GovGuam land. Direct physical disturbance would occur on approximately 382 acres (154 ha), including 275 acres (111 ha) for the construction of the individual ranges, range support building, internal range access roads, and a perimeter fence, plus approximately 107 acres (43 ha) to construct an external LFTRC access road from Route 4. The remaining approximately 3,433 acres (1,389 ha) would include 3,026 acres (1,225 ha) of lands within the SDZ and 407 acres (165 ha) of land surrounding the individual ranges that would not be directly affected by construction or operation of the LFTRC. Alternative 2 would be located in a single location on the non-federal land to the southeast of the NAVMAG. The ranges would be oriented to the west and the composite SDZ would extend over portions of the NAVMAG. Access to the ranges would be via a new access road from Dandan Road that would be constructed with the LFTRC.

Approximately 5 miles (8 km) of roads would be constructed to provide access between the individual ranges. This is the environmentally preferred alternative for the LFTRC.

- NAVMAG (North/South) (Alternative 3): Alternative 3 would comprise approximately 3,549 acres (1,436 ha) (not including the stand-alone hand grenade range at Andersen South) and would require acquisition of 252 acres (102 ha) of GovGuam and privately owned lands. Approximately 370 acres (150 ha) would be required for construction of the proposed range facilities, while 3,179 acres (1,286 ha) would be land within the SDZ that would not be directly affected by construction or operation of the LFTRC. The 370 acres (150 ha) that would be developed would include the areas for construction of the individual ranges, range support building, range access roads, munitions magazine relocation area, and a perimeter fence along the western edge of the LFTRC. An estimated 72 new concrete munitions storage magazines would be constructed at Orote Point to accommodate the transfer of munitions from the existing magazines that would be encumbered by the range SDZs. The existing magazines would be abandoned in place.
- NAVMAG (L-Shaped) (Alternative 4): Alternative 4 would consist of approximately 4,895 acres (1,981 ha) (not including the hand grenade range at Andersen South) and would require the acquisition of approximately 914 acres (370 ha) of privately owned and GovGuam land. Direct physical ground disturbance would occur on approximately 477 acres (193 ha), which would include approximately 356 acres (144 ha) for the construction of the individual ranges, range support building, internal range access roads, munitions magazine relocation area, and a perimeter fence along the western and southern edges of the LFTRC, and approximately 121 acres (49 ha) to construct an external LFTRC access road from Route 4 to the east/west facing ranges (see Figure 2.5-1). The remaining 4,418 acres (1,788 ha) would include 4,165 acres (1,686 ha) of land within the SDZ and 253 acres (102 ha) of land surrounding the individual ranges that would not be built up. An estimated 66 new concrete munitions storage magazines would be constructed at Orote Point to accommodate existing magazines that would be encumbered by the range SDZs. The existing magazines would be abandoned in place.

  Alternative 4 would be divided between two locations: the MPMG Range and range maintenance facility would be located in the same locations identified in Alternative 3, and the other ranges would be located on adjacent non-federal property to the southeast of the NAVMAG (near the area of Alternative 2). Access to the MPMG Range and range maintenance building would be the same as described for Alternative 3. Approximately 1 mile (1.6 km) of new roadway would be required.

  Access to the ranges located east of the NAVMAG would occur via a new access road from Route 4. The new access road would follow the existing road from Route 4 to the Dandan Communication Site and then would continue to the KD Rifle Range. Access between the ranges proposed in the southeastern portion of the LFTRC would be via approximately 3.0 miles (4.8 km) of new roads constructed as part of the LFTRC.
- AAFB-NWF (Alternative 5) (Preferred Alternative): Alternative 5 would consist of approximately 4,016 acres (1,625 ha) (not including the hand grenade range at Andersen South). Although Alternative 5 would not require acquisition of non-federal land, access restrictions already established by the USFWS at the Ritidian Unit of the Guam NWR would be adjusted to account for the establishment of the SDZs for the LFTRC. The Ritidian Unit of the Guam NWR is owned and managed by the USFWS. The DON would pursue an agreement with the USFWS in accordance with the provisions of section 2822 of the FY 2015 NDAA that would allow for

the continued management of the Ritidian Unit consistent with the purposes for which it was established and the operation of the SDZs associated with the LFTRC alternative at AAFB-NWF. The DON anticipates that access restrictions will be addressed in this agreement.

Construction of Alternative 5 would cause direct disturbance to approximately 315 acres (128 ha) of land, including 256 acres (104 ha) for the construction of the individual ranges, range support building, range towers, internal range access roads, a perimeter fence (all within federally controlled land at AAFB-NWF), and the potential relocation of the USFWS facilities within the Ritidian Unit of the Guam NWR that would be encumbered by the range SDZs. The remaining approximately 59 acres (24 ha) of disturbed area would be required for construction to improve existing roadways from the intersection of Routes 3, 3A, and 9 to the Ritidian Unit of the Guam NWR. Conclusion of the consultation under section 7 of the Endangered Species Act (ESA) excluded the proposed relocation of the USFWS facility and the improved access road to the Ritidian Unit of the Guam NWR. Any decisions ensuring continued access to the Ritidian Unit of the Guam NWR are dependent on the outcome of the negotiation of the agreement authorized by section 2822 of the FY 2015 NDAA. The remaining 3,701 acres (1,498 ha) in the overall Alternative 5 footprint would include additional lands and submerged lands under the exclusive custody and control of the DON and the USFWS within the SDZ that would not be affected by construction. This includes approximately 267 acres (108 ha) of the Ritidian Unit of the Guam NWR and 3,434 acres (1,390 ha) of the submerged lands of the Philippine Sea.

In compliance with CEQ's implementing regulations, the DON analyzed the potential environmental consequences of implementing each alternative (and each combination of a cantonment/family housing and a LFTRC alternative) with the same level of scrutiny. The 2015 Final SEIS evaluated all alternatives for potential direct, indirect, additive (associated with combinations of cantonment/family housing and LFTRC alternatives), and cumulative impacts.

No-Action Alternative: Under the No-Action Alternative, the DON would continue to implement the 2010 Final EIS and ROD. The decision to construct and operate the LFTRC would remain deferred, and the DON would establish a cantonment/family housing area for a larger force of approximately 8,600 Marines and approximately 9,000 dependents on federally controlled lands at Finegayan and South Finegayan by acquiring land known as the former FAA parcel. The No-Action Alternative is not a reasonable alternative because it would not meet the purpose and need for the proposed action as defined above. Foremost, it would be inconsistent with the new force posture adopted by the DoD in accordance with the 2012 Roadmap Adjustments that provides for a materially smaller relocated force on Guam. Furthermore, the No-Action Alternative would neither satisfy the training requirements for the relocated Marines as mandated by 10 U.S.C. § 5063 nor satisfy the individual live-fire training requirements as described in the 2010 Final EIS and ROD. Although the No-Action Alternative presumes the course of action identified in the 2010 ROD, for purposes of assessing the environmental impacts of the proposed alternatives in the 2015 SEIS, the DON compared the impacts of the proposed action to the baseline conditions identified in the 2010 Final EIS. The DON updated baseline conditions, as appropriate, based upon the availability of new information.

ENVIRONMENTAL IMPACTS: The DON prepared the 2015 Final SEIS to evaluate the potential environmental consequences of implementing each of the alternatives that were carried forward for analysis. Impacts were assessed for the following resource areas: geological and soil resources; water resources; air quality; noise; airspace; land and submerged land use; recreation; terrestrial biological resources; marine biological resources; cultural resources; visual resources; ground transportation; marine transportation; utilities; socioeconomics and general services; hazardous materials and waste; public

health and safety; and environmental justice/protection of children. The following discussion summarizes environmental impacts for the alternatives selected for implementation in this ROD (Alternative E and Alternative 5) and only addresses those resources that may result in significant impacts or significant but mitigable impacts. The significant impacts designation applies to impacts that may be significant, and either no mitigation measures were identified that could reduce the impact to a less than significant level or the impact may remain significant even with the application of mitigation measures. The significant but mitigable impacts designation applies when the impact on a resource may be significant without mitigation but may be reduced to a less than significant level with the application of identified mitigation measures. This section of the ROD summarizes the potential impacts, while associated mitigation measures are summarized in a later section.

The 2015 Final SEIS also evaluated additive impacts and cumulative effects. Additive impacts are those associated with a particular cantonment/family housing alternative being paired with a particular LFTRC alternative (e.g., the traffic generated between the cantonment and the LFTRC or the effects of installing information technology/communications [IT/COMM] infrastructure between a specific cantonment/family housing area, a LFTRC, and other DoD facilities on Guam). Cumulative effects are the potential impacts associated with implementing the proposed action in conjunction with those projects that remained final under the 2010 ROD and not subject to further analysis and other past, present, and reasonably foreseeable future projects on Guam.

Significant Impacts of Cantonment/Family Housing Alternative E – Finegayan/AAFB

Water Resources

Construction Impacts

Groundwater: The Guam Waterworks Authority's (GWA) interceptor sewer from AAFB to the Northern District Wastewater Treatment Plant (WWTP) is in a state of deterioration, and the number of spills from this system exceeds spill rate norms for similar wastewater systems. Increased wastewater flows associated with the construction/DoD workforce and induced civilian population growth during the construction phase of Alternative E will potentially accelerate deterioration and increase the rate of sewage spills, resulting in significant but mitigable indirect impacts to groundwater quality.

Nearshore Waters: Increased wastewater flows associated with induced civilian and construction/DoD workforce growth under Alternative E would result in a significant and unmitigable, indirect impact to nearshore waters from increased wastewater discharge from the Northern District WWTP outfall. The Northern District WWTP is non-compliant with the current (2013) National Pollutant Discharge Elimination System (NPDES) permit and increasing the wastewater discharge and corresponding increases in pollutants (e.g., orthophosphates, nitrate-nitrogen, and ammonia) from a non-compliant treatment plant would be a significant indirect impact during the period of noncompliance. WWTP upgrades are not anticipated to be completed until early in the operational phase of the proposed action. There would be an indirect and unmitigable significant impact to nearshore waters during construction until upgrades are complete.

Operation Impacts

Groundwater: Operation of the cantonment/family housing facilities under Alternative E would result in a significant but mitigable impact to groundwater in the form of a long-term increase in annual groundwater production (withdrawal) of 1.7 million gallons per day, which could result in a localized significant indirect impact to the Northern Guam Lens Aquifer (NGLA). In addition, the GWA interceptor sewer from AAFB to the Northern District WWTP is in a state of deterioration that requires refurbishment.

Increased wastewater flow from the proposed relocation would potentially accelerate this deterioration and increase the rate of sewage spills, resulting in a significant but mitigable indirect impact to groundwater quality from potential exposure to additional raw sewage.

Nearshore Waters: Operation of the cantonment and family housing facilities under Alternative E would result in a significant but mitigable impact to nearshore waters from increased wastewater discharge and corresponding pollutants as described above from the Northern District WWTP outfall. Increasing wastewater discharge from a non-compliant treatment plant would be a significant indirect impact during the period of non-compliance.

Terrestrial Biological Resources

Construction Impacts

Vegetation: Construction of the cantonment facilities under Alternative E would result in a significant but mitigable impact to vegetation as a result of the conversion of 780 acres (316 ha) of limestone forest to developed area. Construction of the family housing facilities under Alternative E would have a less than significant impact to this resource.

Terrestrial Conservation Areas: Construction of the cantonment facilities under Alternative E would result in a significant but mitigable impact to terrestrial conservation areas as a result of the conversion of 1,065 acres (431 ha) of Overlay Refuge lands to developed area.

Special-Status Species – Endangered Species Act (ESA) (16 U.S.C. §§ 1531 *et seq.*) – *Listed/Proposed Species:* Construction of the cantonment and family housing facilities under Alternative E would result in significant but mitigable impacts to special-status species (ESA-listed/proposed species) as a result of impacts to 719 acres (291 ha) of Mariana fruit bat recovery habitat, 719 acres (291 ha) of Mariana crow recovery habitat, 507 acres (205 ha) of Guam rail recovery habitat, 719 acres (291 ha) of Guam Micronesian kingfisher recovery habitat, and 648 acres (262 ha) of *Serianthes* recovery habitat conversion to developed area.

Special-Status Species – Guam-Listed and Species of Greatest Conservation Need (SOGCN): Impacts and mitigation associated with Guam-listed species that are also listed under the ESA would be the same as those described above. Impacts to other Guam-listed species from construction of the cantonment facilities under Alternative E would include significant but mitigable impacts to special-status species (Guam-listed and SOGCN) as a result of the loss of 765 acres (310 ha) of occupied moth skink and Pacific slender-toed gecko habitat.

Operation Impacts

Terrestrial Conservation Areas: Operation of the cantonment/family housing facilities under Alternative E would result in a significant but mitigable impact to terrestrial conservation areas as a result of potential increased usage by military and civilian personnel that could damage the vegetation of the Haputo Ecological Reserve Area (ERA).

Special-Status Species – ESA-Listed/Proposed Species: Operation of the cantonment/family housing facilities under Alternative E would result in significant but mitigable impacts to special-status species (ESA-listed/proposed species) as a result of impacts to Mariana fruit bat habitat from light, noise, and human activity.

Marine Biological Resources

Construction Impacts

Induced civilian and construction/DoD workforce growth under Alternative E would result in a significant, unmitigable, indirect impact to marine flora and invertebrates, fish, and Essential Fish Habitat (EFH) from increased wastewater discharge and corresponding increases in pollutants (e.g., orthophosphates, nitrate-nitrogen, and ammonia) from the Northern District WWTP outfall. The Northern District WWTP is non-compliant with the standards required by its current NPDES permit and increasing the wastewater discharge from a non-compliant treatment plant would be a significant, indirect impact. WWTP upgrades are not anticipated to be completed until early in the operational phase of the proposed action. There would be an indirect and unmitigable, significant impact to nearshore waters during construction until upgrades are complete.

Operation Impacts

Operation of the cantonment and family housing facilities under Alternative E would result in a significant but mitigable impact to marine flora and invertebrates, fish, and EFH from increased wastewater discharge, as described above, from Northern District WWTP outfall. Increasing wastewater discharge from a non-compliant treatment plant would result in significant, indirect impacts during the period of non-compliance.

Cultural Resources

Construction Impacts

Construction of the cantonment/housing family housing facilities under Alternative E would result in significant but mitigable, potential, direct, adverse effects to 17 historic properties (16 National Register of Historic Places [NRHP]-eligible archaeological sites and 1 NRHP-eligible structure) and 14 buildings not fully evaluated for NRHP eligibility and effects. All potential effects to historic properties are subject to further review under the 2011 PA.

Utilities

Construction Impacts

Wastewater: Construction of the cantonment/family housing facilities under Alternative E would result in significant direct impacts during the period of non-compliance with the 2013 NPDES permit at the Northern District WWTP.

Operation Impacts

Potable Water (NGLA Impact): Operation of the cantonment/family housing facilities under Alternative E would result in significant but mitigable, short-term, localized significant impacts to the affected basin within the NGLA but less than significant impacts to the overall NGLA. Increased withdrawal from the NGLA may result in higher levels of chloride concentrations. According to U.S. Geological Survey (USGS) modeling of the NGLA, the chloride concentration spikes could be a localized phenomenon.

Wastewater: Operation of the cantonment/family housing facilities under Alternative E would result in significant direct impacts during the period of non-compliance with the 2013 NPDES permit at the Northern District WWTP. Operation of the cantonment/family housing facilities would also generate additional wastewater flow from both AAFB family housing facilities and Finegayan cantonment that would use the existing GWA interceptor sewer system from AAFB to the Northern District WWTP. This interceptor sewer system is in a state of deterioration that requires rehabilitation. Increased flow

associated with Alternative E would accelerate this deterioration and could lead to failure of the sewer system. This would represent a significant but mitigable impact.

Socioeconomics and General Services

Construction and Operation Impacts

Population Change: The population change associated with the Marine Corps relocation would be considered significant during both the construction and operations phases (given that population change would exceed 2%). Between 2021 and 2023, the population would be 5.6% higher than it otherwise would have been without the proposed action. At a steady-state the difference would be 4.1%. However, the significant change would not be considered entirely negative. Impacts related to population change would be mixed, with some adverse and some beneficial outcomes associated with the increased demand for public services and sociocultural issues described below.

Public Services: During construction, all categories of public services agencies combined would require an estimated 185 additional employees, an increase of 3.6% over baseline staffing levels. This maximum increase in staffing levels would be temporary, lasting from approximately 2021 through 2023. During this two-year period, staffing requirements for many public service agencies would increase by more than 2%. Given existing deficiencies at many agencies, significant impacts were identified. However, over the longer term, Guam government (GovGuam) agencies would require an additional 66 staff (an increase of 1.3% over baseline levels), which would be less than significant. From a broad perspective, looking at the entire group of GovGuam public services agencies overall, impacts would be considered significant in the short-term and less than significant in the long term. While the total number of additional staff required during the relatively short construction phase may appear manageable (representing only a 3.6% increase over baseline staffing), other factors, including existing shortfalls in staffing and deficiencies in facilities and equipment were considered when determining significance. The population increase likely would not result in a significant sustained increase in demand on Guam's public services and permitting agencies, and the estimated increases in GovGuam tax revenues would likely compensate for any increased demand on public services that would occur. However, while additional tax revenues to GovGuam associated with the proposed action would compensate for additional costs that would be incurred and ample time should be available to plan for short-term staff increases, GovGuam agencies may still face challenges.

Sociocultural Issues: There is a potential for sociocultural impact associated with an increase in crime and social disorder, political and Chamorro issues, and community cohesion to occur, but the magnitude of the impacts are difficult to predict and could vary substantially based on policy and program choices yet to be made. For these reasons, and for the purposes of the 2015 Final SEIS, impacts to sociocultural issues are conservatively classified as significant but mitigable.

Environmental Justice and Protection of Children

Construction and Operation Impacts

Socioeconomics and General Services: Temporary population growth may stress some sectors of the Guam economy (e.g., housing, costs of goods and services). In the short-term (during construction), direct and indirect impacts to health services would be significant; during the steady-state period (operational phase), impacts to public health and human service agencies would be less than significant.

This impact would be felt more severely by low-income people, who often do not have resources to buffer hard economic times. However, there would also be some economic benefits as a result of increased employment opportunities. There would be adverse and disproportionate socioeconomic impacts in terms

of environmental justice on low-income populations; however, some of the socioeconomic impacts would be beneficial (e.g., economic opportunities).

Public Health and Safety: Since the number of public health and safety professionals required to maintain current levels of service at public health and safety agencies would increase by more than 2%, and because deficiencies currently exist in facilities and equipment at these agencies, there would be short-term, direct, and indirect significant impacts to public health agencies and significant, direct, and indirect impacts on public safety agencies, both in the short term (during construction) and during the steady-state period (during operation). Given that public health agencies that serve low-income and uninsured populations already have insufficient staffing levels, population increases would further strain these resources, causing a significant environmental justice impact.

Significant Impacts of LFTRC Alternative 5 – AAFB-NWF

Geological and Soil Resources

Construction Impacts

Topography: Construction of the LFTRC under Alternative 5 would result in a significant, direct, long-term impact to topography in the form of major changes to surface elevation from excavation and filling during construction.

Land and Submerged Land Use

Operation Impacts

Public Access: Although the land and submerged land use within the Ritidian Unit of the Guam NWR would remain as Conservation land use, there will be access restrictions to those lands within the SDZs while the ranges are in use. Such restrictions would be limited to the minimum SDZ area and time period required for the training on the LFTRC. Access to submerged lands adjacent to the Ritidian Unit under the custody and control of the DON would be similarly restricted.

Recreational Resources

Operation Impacts

Operation of the LFTRC under Alternative 5 would result in significant impacts as a result of intermittent loss of access (while the SDZ for the LFTRC is operational) to existing features or sites such as hiking trails, caves and other sites of interest within the Ritidian Unit of the Guam NWR. As discussed previously, access to areas within the Ritidian Unit of the Guam NWR will be addressed in the Refuge Agreement between the DON and the USFWS, pursuant to the FY 2015 NDAA and will ensure maximum, continued access. Some of these sites are currently open for access during normal refuge hours; access to others are currently restricted by the USFWS. Access to the areas within the largest of the range SDZs would be restricted during that range's operational periods. Recreational resources within that SDZ include a portion of existing hiking trails and caves with pictographs within the Ritidian Unit of the Guam NWR.

Terrestrial Biological Resources

Construction Impacts

Vegetation: Construction of the LFTRC under Alternative 5 would result in a significant but mitigable impact to vegetation as a result of the conversion of 219 acres (89 ha) of limestone forest to developed area.

Terrestrial Conservation Areas: Construction of the LFTRC under Alternative 5 would result in a significant but mitigable impact to terrestrial conservation areas as a result of the conversion of 298 acres (121 ha) of Overlay Refuge lands to developed area.

Special-Status Species – ESA-Listed/Proposed Species and Critical Habitat: Construction of the LFTRC under Alternative 5 would result in a significant but mitigable impact to special-status species as a result of impacts to 215 acres (87 ha) of Mariana fruit bat recovery habitat, 215 acres (87 ha) of Mariana crow recovery habitat, and 215 acres (87 ha) of Guam Micronesian kingfisher recovery habitat conversion to developed areas. The Mariana fruit bat may also be impacted by noise, human disturbance, and lighting during both construction and operation because they are present in the action area.

Special-Status Species – Guam-Listed and SOGCN: Impacts associated with Guam-listed species that are also federally listed would be the same as described above for those species. No additional Guam-listed species are known to occur in the project area for Alternative 5.

Cultural Resources

Construction Impacts

Construction of the LFTRC under Alternative 5 would result in significant but mitigable impacts. Twenty historic properties would be directly, adversely affected, and culturally important natural resources could be impacted by vegetation removal.

Operation Impacts

Operation of the LFTRC under Alternative 5 would result in significant impacts, which are not fully mitigable, due to restricted access to two NRHP-eligible archaeological sites. Significant but mitigable impacts would result from indirect, adverse effects to three NRHP-eligible archaeological sites as a result of substantial changes in the audible environment.

Significant Additive Impacts of the Selected Alternatives

For the purposes of the 2015 Final SEIS, additive impacts are those that would result specifically from the combination of a cantonment/family housing alternative with a LFTRC alternative. These project impacts were addressed in Chapter 6 of the 2015 Final SEIS. The additive impacts resulting from the selected combination of cantonment/family housing Alternative E and LFTRC Alternative 5 would yield additional, significant but mitigable impacts to two resource areas: cultural resources and ground transportation.

Cultural Resources

There would be significant but mitigable impacts as a result of potential adverse effects to six known historic properties from construction of IT/COMM lines. There would be no adverse effects from operation of IT/COMM lines once construction is complete.

Ground Transportation

There would be a slight increase in traffic on segments and intersections between the cantonment at Finegayan, the family housing at AAFB, and the LFTRC at AAFB-NWF. There would be potentially significant impact on eight segments in at least one direction and ten intersections for weekday a.m. and/or p.m. peak hours.

Significant Cumulative Impacts of the Selected Alternative

The assessment of cumulative effects presented in Chapter 7 of the 2015 Final SEIS addressed the potential long-term impacts of recently completed, present, and reasonably foreseeable future projects in conjunction with the proposed action. The resources most likely to be adversely affected by these projects are terrestrial biological and cultural resources. This is largely due to the fact that most projects would result in ground disturbance and potential for removal or disturbance of habitat and cultural resources. The resource areas that benefit most from the projects evaluated for cumulative effects are ground transportation, utilities, socioeconomic and general services, public health and safety, and environmental justice/protection of children. This is because many of the evaluated projects are capital improvement projects designed to support the health and safety of the community, as discussed in the mitigation section below. A nearly equal number of projects having adverse and beneficial impacts were identified for geological and soil resources and water resources. Air quality, noise, airspace, land use, recreational resources, and marine transportation resource areas are impacted by fewer projects than other resource areas, either beneficially or adversely.

A brief summary of cumulative impacts to terrestrial biological resources and cultural resources is discussed below.

Terrestrial Biological Resources

The following are the general types of projects or activities that would result in cumulative impacts to terrestrial biological resources:

- Loss or conversion of native habitat would reduce the potential recovery and survival of ESA-listed species creating an adverse impact.
- Reductions and management activities (e.g., fencing, removal) of invasive species and/or feral ungulates or their access to habitat would have a beneficial impact.
- Projects involving ground disturbance (e.g., construction of housing or new and widened roadways) would contribute to an adverse cumulative effect. Projects that are renovations or improvements to existing facilities (e.g., resurfacing a roadway) within the existing facility footprint would have no impact on terrestrial biological resources.

The proposed action and recently completed projects, present projects, and reasonably foreseeable projects all have the potential to contribute to adverse cumulative effects to terrestrial biological resources. The primary impact from these projects would be the loss of native habitat and the increased potential for the spread of invasive species. Most of the projects require ground disturbance, and the assumption is that terrestrial biological resources would be affected. The terrestrial biological resource health on Guam would continue to decline, and threatened and endangered species would continue to be vulnerable to natural and anthropogenic stressors.

Cultural Resources

The following are the general types of projects that would result in cumulative impacts to cultural resources:

- Projects that result in adverse effects to historic properties can lead to a cumulative loss of the archaeological and built-historical record that could contribute to an adverse cumulative impact.
- Projects that affect culturally important natural resources can lead to an adverse cumulative impact.

- Projects that lead to reduced access to cultural sites can lead to an adverse cumulative impact.

Recently completed projects, present projects, and reasonably foreseeable projects all have the potential to contribute to adverse cumulative effects to cultural resources. The primary impact from these projects would be direct and indirect, adverse effects to historic properties, archaeological sites, and impacts to culturally important natural resources. Direct and indirect, adverse effects would contribute to the decline in preservation of cultural resources. Other factors unrelated to the project (e.g., vandalism and weathering) would continue to adversely impact cultural resources. Disturbance or destruction of cultural resources would further diminish the regional historic record, thus decreasing the potential of its overall research contribution. The loss of culturally important natural resources would reduce opportunities for important cultural practices. Reduced access to cultural sites, whether for cultural practices, recreation, tourism, or academic study would also diminish the cultural resources of Guam.

MITIGATION MEASURES AND MONITORING: The impact analyses described in the 2015 Final SEIS considered the influence of Best Management Practices (BMPs) as well as mitigation measures. BMPs are existing policies, practices, and measures that the DON will adopt to proactively reduce the environmental impacts of designated activities, functions, or processes. Although BMPs help to avoid, minimize, or reduce/eliminate impacts, they are distinguished from potential mitigation measures because they are (1) included in the proposed action, (2) ongoing, regularly occurring practices, or (3) not unique to the proposed action. In other words, the BMPs are proposed as part of the action (all alternatives) and are not targeted mitigation measures identified in response to the findings of the NEPA environmental review process. Specific BMPs that are included in the proposed action are described in section 2.8 of the 2015 Final SEIS.

Consistent with the CEQ Guidance, mitigation measures developed to address specific impacts identified in the 2015 Final SEIS analysis are described below. Mitigation measures will be monitored and tracked as required by applicable DON regulations and instructions. Implementation of mitigation measures will be subject to availability of funding. Implementation of ground transportation mitigation projects will be determined through the Defense Access Road Program.

Mitigation Measures for Impacts Associated with the Cantonment/Family Housing Alternative E

Mitigation for Water Resources Impacts

Groundwater

- Refurbishment of the GWA interceptor sewer system will mitigate significant impacts to groundwater resources during the construction phase of the proposed action. Section 2822(d) of the FY 2014 NDAA directed the Secretary of Defense to convene the Economic Adjustment Committee (EAC) established in Executive Order No. 127887 "to consider assistance, including assistance to support public infrastructure requirements, necessary to support the preferred alternative for the relocation of Marine Corps forces to Guam." Section 2822(d) further requires the EAC to submit a report to congressional defense committees which includes an Implementation Plan that addresses public infrastructure requirements necessary to support the preferred alternative identified in the Final SEIS. The EAC Implementation Plan, which was coordinated with EAC federal agencies, includes detailed descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP, and expansion/rehabilitation of the NGLA monitoring network for sustainment of the NGLA. To support the Implementation Plan, EAC

assessed GWA water and wastewater systems that may be affected by the preferred alternative. The water and wastewater assessment recommended an updated and expanded NGLA monitoring well network and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. In addition to funds ($106.4 million) previously appropriated to the Secretary of Defense under section 8102 of the FY 2014 Consolidated Appropriations Act (Pub. L. No. 113-76), DoD will seek additional funding ($67.5 million) to complete the necessary Guam water and wastewater system upgrades identified in the EAC Implementation Plan that are estimated to be no more than $173.9 million.

- The DoD will, as appropriate, implement enhanced water conservation measures for the proposed action, improve existing DoD potable water systems to reduce system leaks, adjust pumping rates at DoD wells, and increase the use of existing wells and/or surface water from Fena Reservoir to reduce withdrawals from the NGLA.
- The DoD will continue to support the Guam Water Resources Development Group (GWRDG) and support the USGS's recommendation to rehabilitate and expand the hydrologic data collection network and monitoring necessary to ensure sustainable management of NGLA.

Nearshore Waters

Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit, the section 7 ESA consultation and the Magnuson-Stevens Fisheries Conservation Management Act [MSA] [16 U.S.C. § 1801-1891(d)] consultation with the National Marines Fisheries Service [NMFS]) will mitigate significant impacts to the wastewater system on Guam once the upgrades are completed. In addition, refurbishing the main GWA sewer lines from AAFB to the Northern District WWTP along Routes 3 and 9 will mitigate potential failure of the concrete reinforced sewer lines that are in a state of deterioration. The EAC Implementation Plan will include detailed descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. The water and wastewater assessment that EAC prepared to support the Implementation Plan recommended upgrades to the Northern District WWTP and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. In addition to funds ($106.4 million) previously appropriated to the Secretary of Defense under section 8102 of the FY 2014 Consolidated Appropriations Act (Pub. L. No. 113-76); the DoD will seek additional funding ($67.5 million) to complete the necessary Guam water and wastewater system upgrades identified in the EAC Implementation Plan. The costs are estimated to be no more than $173.9 million.

Mitigation for Terrestrial Biological Resources Impacts

A general description of conservation measures and mitigations for terrestrial biological resources as included in the 2015 Final SEIS are provided below. As a result of completing ESA section 7 consultation with the USFWS, the DON received a final biological opinion (BO) on July 31, 2015. This BO contains detailed descriptions of the conservation measures, BMPs, additional mitigation in the form of reasonable and prudent measures, and associated terms and conditions for minimizing the anticipated incidental take of 30 Mariana fruit bats in the form of repeated harassment. The DON commits to all the conservation measures, BMPs, reasonable and prudent measures, and terms and conditions as expressed in the BO (section B, pages 36-46, and sections K & L, pages 156-159). These measures include:

Vegetation

- Forest enhancement on a minimum of 780 acres (316 ha) of limestone forest.

Terrestrial Conservation Areas

- Install fencing.
- Install informational/educational signage.
- Develop and distribute educational materials regarding sensitive biological resources.
- Conduct monitoring of visitor use at the Haputo ERA.

Special-Status Species – Federal ESA and Proposed

- Control and suppression of brown treesnakes.
- Implement forest enhancement mitigation identified for vegetation will also benefit these species.
- Install fencing, provide informational/educational signage and educational materials regarding sensitive biological resources, and monitor of visitor use at Haputo ERA.

Special-Status Species – Guam-Listed and Species of Greatest Conservation Need

- Implement the forest enhancement mitigation identified for vegetation will also benefit these species.

Mitigation for Marine Biological Resources Impacts

- Upgrade the Northern District WWTP treatment systems (as required by the 2013 NPDES permit, the section 7 ESA consultation and the MSA (16 U.S.C. §§ 1801–1891(d)) consultation with the NMFS) as described above will mitigate significant impacts to marine biological resources.

- Monitor stormwater BMP effectiveness and if practicable, design and implement additional processes to determine the fate of stormwater for the Finegayan Cantonment and AAFB-NWF LFTRC, to sensitive nearshore reefs such as the habitat areas of particular concern (HAPCs) at Haputo ERA and the Ritidian Unit of the Guam NWR.

- Provide guidelines for programs to minimize impacts from training, recreation, and fishing activities for Marine Corps personnel.

- Institute physical training awareness and operational guidance that identifies appropriate physical training areas and sensitive areas that are off-limits for such activities in coordination with installation and regional resource management plans.

- Coordinate updates to the Joint Region Marianas (JRM) Integrated Natural Resources Management Plan and installation fishing instructions to include increased awareness about destructive fishing methods for all DoD personnel deployed or permanently assigned to Guam and the CNMI for submerged lands beyond the custody and control of the DoD. The DON will also consider instituting a ban on all DoD personnel from using scuba for fishing and fishing for species of local concern such as humphead wrasse and green humphead parrotfish.

Mitigation for Cultural Resources Impacts

- Implement the 2011 PA. Mitigation processes include reviewing projects as they are developed to confirm the identification of historic properties and appropriate measures to avoid, minimize, and mitigate adverse effects. The 2011 PA requires consultation with the public and the PA Parties, which include Guam SHPO, ACHP, NPS, Guam Preservation Trust (GPT), and the Department of Chamorro Affairs (DCA). Potential impacts to culturally important natural resources will be addressed through requirements in the 2011 PA in coordination with knowledgeable traditional practitioners.

Mitigation for Utilities Impacts

Wastewater

- Potential mitigation measures during construction may include constructing sewers during low flow periods by-pass pumping and having pump trucks on stand-by.
- Upgrades to the Northern District WWTP treatment systems (as required by the 2013 NPDES permit), as described above, will mitigate significant impacts to the wastewater system on Guam. In addition, refurbishing the main GWA sewer lines from AAFB to the Northern District WWTP along Routes 3 and 9 will mitigate potential failure of the concrete reinforced sewer lines that are in a state of deterioration.

Potable Water

- The DoD will, as appropriate, implement enhanced water conservation measures for the proposed action, improve existing DoD water systems to reduce system leaks, adjust pumping rates at DoD wells, and increase the use of surface water in northern Guam from Fena Reservoir to reduce withdrawals from the NGLA.
- The DoD will continue to support the GWRDG and the USGS' recommendation to rehabilitate and expand the hydrologic data collection network and monitoring necessary to ensure sustainable management of NGLA.
- As discussed in groundwater mitigation, expansion/rehabilitation of the NGLA monitoring network for sustainment of the NGLA will mitigate significant impacts to potable water.

Mitigation for Socioeconomics and General Services Impacts

Public Services

- Although the DON has determined that Adaptive Program Management as described in the 2010 ROD is no longer required (see section 2.9.2 of the 2015 Final SEIS), the DoD will continue to work towards a charter as described in the 2010 ROD and support the efforts of the Civilian Military Coordination Council (CMCC) to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded. Such support may include providing project-related employment and population forecasts, participating in the identification of shortfalls in Guam public services, and assisting in the identification of federal programs and funding sources that may help GovGuam to address shortfalls.

- The DoD will continue to support existing programs that contribute and/or donate excess equipment to local agencies.

Sociocultural Issues

- Conduct orientation briefs, in accordance with the 2011 PA, for all incoming DoD personnel, their families, and contractors regarding cultural sensitivity in the area. All DoD personnel and contractors working on Guam will receive annual briefings. The DoD will develop the briefing in consultation with the Guam SHPO and will provide Guam SHPO with a copy of the final briefing materials.
- The DoD will continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth to address sociocultural issues.
- Consistent with the 2011 PA, the DoD has developed a public access plan in coordination with the public and interested parties. The access plan provides a consistent process for regular public access and a point of contact to handle requests for access to cultural sites on DoD lands.
- In accordance with the 2011 PA, the $12 millon appropriated under the FY 2012 Consolidated Appropriations Act (Pub. L. No. 112-74) for a Guam Cultural Repository facility to mitigate cumulative impacts remains available. The appropriation provides funding for a repository for curation of archaeological collections on Guam and to serve as a source of information on Guam history and culture. Guam Cultural Repository is included in the EAC Implementation Plan, which addresses public infrastructure requirements necessary to support the preferred alternative. The EAC Implementation Plan will include detailed description of work, cost, and schedule for completion of construction of the Guam Cultural Repository. After the release of this ROD, the EAC Implementation Plan will be submitted to the congressional defense committees as part of a FY 2014 NDAA reporting requirement.

Mitigation for Environmental Justice and Protection of Children Impacts

Socioeconomics and General Services

- The DoD will consider the recommendations, if any, of the CMCC to adjust the construction tempo and sequencing if necessary to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded.

Public Health and Safety

- The DoD will consider the recommendations, if any, of the CMCC to adjust the construction tempo and sequencing if necessary to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded.
- The construction of a public health laboratory to alleviate some existing deficiencies in Guam's public health infrastructure, and bolster Guam's capability to meet public health demands brought about by project-related population growth and the rotational nature of the deployable units for training in the region by providing a facility that would help identify, treat, and control diseases of public health concern. The EAC Implementation Plan, which was coordinated with EAC federal agencies, will include detailed descriptions of work, costs, and schedules for completion of construction for a regional public health laboratory with bio-safety level 2 and 3 analytical

testing capability. The cost estimate for a regional public health laboratory with bio-safety level 2 and 3 is no more than $32.2 million. In addition to funds ($13 million) previously appropriated to the Secretary of Defense under section 8102 of the FY 2014 Consolidated Appropriations Act (Pub. L. No. 113-76), DoD will seek additional funding ($19.2 million). After the release of this ROD, the EAC Implementation Plan will be submitted to the congressional defense committees as part of a FY 2014 NDAA reporting requirement.

Mitigation Measures for Impacts Associated with LFTRC Alternative 5

Mitigation for Terrestrial Biological Resources Impacts

A general description of conservation measures and mitigations for terrestrial resources as included in the 2015 Final SEIS are provided below. As a result of completing section 7 ESA consultation with the USFWS, the DON received a final BO on July 31, 2015. This BO contains detailed descriptions of the conservation measures, BMPs, additional mitigations in the form of reasonable and prudent measures, and associated terms and conditions for minimizing the anticipated incidental take of 30 Mariana fruit bats in the form of repeated harassment. The DON commits to all the conservation measures, BMPs, reasonable and prudent measures, and terms and conditions as expressed in the BO (section B, pages 36-46, and sections K & L, pages 156-159). These measures include:

Vegetation

- Forest enhancement on a minimum of 219 acres (89 ha) of limestone forest.

Special-Status Species – ESA-Listed/Proposed Species and Critical Habitat

- Implementing the forest enhancement identified for vegetation on a minimum of 219 acres (87 ha) of limestone forest vegetation will also benefit these species.
- Control and suppression of brown treesnakes.

Mitigation for Cultural Resources Impacts

- Implement the 2011 PA. Processes will include reviewing projects as they are developed to confirm the identification of historic properties and appropriate measures to avoid, minimize, and mitigate adverse effects. The 2011 PA requires consultation with the public and the PA Parties, which include the Guam SHPO, the ACHP, NPS, GPT, and the DCA.
- Section 5(c)(4) of the 2011 PA requires development of a Range Mitigation Plan (RMP) for the construction and operation of the LFTRC. The plan will stipulate mitigation measures such as data recovery for archaeological sites, development of public education and interpretive materials, and coordination with knowledgeable traditional practitioners for culturally important natural resources.
- Partial mitigation of significant impacts resulting from changes in use and reduced access will be accomplished through the RMP, which will identify and evaluate potentially appropriate noise-reducing measures. Access will be coordinated through the existing access plan and in consultation with the USFWS.

Mitigation Measures for Additive Impacts: Combination of Alternative E and Alternative 5

Cultural Resources

- Measures outlined in the 2011 PA will reduce additive impacts to a level below significance.

Ground Transportation

To reduce impacts to less than significant levels on roadway segments, the following eight roadway widening projects are recommended for implementation when determined to be eligible through the Defense Access Roads program and when funding is available:

- Route 1, from Route 3 to Route 34
- Route 1, from Route 34 to Route 16
- Route 3, from Route 3A/9 to Finegayan Main Gate
- Route 3, from Finegayan Main Gate to Finegayan Residential Gate
- Route 3, from Finegayan Residential Gate to Route 28
- Route 3, from Route 28 to South Finegayan Main Gate
- Route 3, from South Finegayan Main Gate to Route 1
- Route 28, from Chalan Balako to Route 3

In addition, the DON acknowledges that to reduce impacts to less than significant levels on intersections, improvement projects are recommended at the following intersections:

- Route 3/3A/9
- Route 3/Royal Palm Drive
- Route 1/Route 3
- Route 1/Route 27
- Route 1/Route 26
- Route 16/Route 27
- Route 16/Route 10A
- Route 1/Route 14A
- Route1/Route 10A

Mitigation Measures for Cumulative Impacts

Terrestrial Biological Resources

- No additional mitigation is proposed for cumulative impacts to terrestrial biological resources. GovGuam reviews public, private, and commercial development proposals for potential impacts to terrestrial biological resources. The USFWS monitors GovGuam, private and commercial development proposals and periodically adjusts the acreage of available recovery habitat island-wide. This adjustment is used to determine the impact of federal development proposals that must comply with section 7 of the ESA and may result in mitigation for federal development proposals.
- The DON completed section 7 ESA consultation with the USFWS on July 31, 2015. This consultation included the potential cumulative direct and indirect effects of the proposed military relocation.

Cultural Resources

- Support Guam SHPO's update of the Guam Historic Preservation Plan.

- Update, beginning in 2017, the Guam Synthesis with information from DoD studies in concert with the Guam Historic Preservation Plan.
- Nominate two or more historic properties on DoD land per year for listing in the NRHP.
- In accordance with the 2011 PA, the $12 million appropriated under the FY 2012 Consolidated Appropriations Act (Pub. L. No. 112-74) for a Guam Cultural Repository facility to mitigate cumulative impacts remains in place. The appropriation provides funding for a repository for curation of archaeological collections on Guam and to serve as a source of information on Guam history and culture. Guam Cultural Repository is included in the EAC Implementation Plan, which addresses public infrastructure requirements necessary to support the preferred alternative. The EAC Implementation Plan details description of work, cost, and schedule for completion of construction of the Guam Cultural Repository. After the release of this ROD, the EAC Implementation Plan will be submitted to the congressional defense committees as part of a reporting requirement.

AGENCY COORDINATION AND CONSULTATION:

Cooperating Agency Coordination

The following agencies participated in the preparation of this SEIS as Cooperating Agencies: U.S. Air Force, FAA, Federal Highway Administration, EPA Region 9, U.S. Department of Interior (DOI) – Office of Insular Affairs, and the U.S. Department of Agriculture. As defined in 40 CFR § 1508.5, a cooperating agency "means any federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major federal action significantly affecting the quality of the human environment." A cooperating agency's responsibilities include participation in the NEPA process as early as possible, participation in the scoping process, and, upon the lead agency's request, development of information to be included in the EIS and staff support during EIS preparation (40 CFR § 1501.6). Under 40 CFR § 1501.6, federal agencies with jurisdiction by law shall be cooperating agencies if requested by the lead agency.

Each agency signed a letter of agreement indicating its willingness to be a cooperating agency, and agreed to specific roles and responsibilities for the lead and cooperating agencies (see the 2015 SEIS, Appendix C, *Agency Correspondence*). As the lead agency, the DON has met its obligations to the cooperating agencies, including routine and periodically frequent coordination throughout the SEIS process. The cooperating agencies have also fulfilled their obligations as stipulated in their agreement.

Agency Consultations

Endangered Species Act

In accordance with section 7 of the ESA, the DON initiated and concluded formal consultation with the USFWS on the potential impacts of the proposed military relocation on eight listed species: the Mariana fruit bat (threatened), the Mariana crow (endangered and extirpated), the Guam rail (endangered and extirpated), the Guam Micronesian kingfisher (endangered and extirpated), the green sea turtle (threatened), the hawksbill sea turtle (endangered), the Hayun lagu (*Serianthes nelsonii* endangered), and the Mariana gray swiftlet (endangered). The consultation also included analysis of potential impacts to designated critical habitat for the fruit bat, crow, and kingfisher. The USFWS provided the DON its BO on July 31, 2015. This BO concurred in the DON determination that the proposed action would not likely adversely affect the Mariana gray swiftlet, the green sea turtle, and the hawksbill sea turtle. The BO

concluded that the proposed military relocation would adversely affect the Mariana fruit bat and the Hayun lagu, but not likely appreciably reduce the likelihood of both survival and recovery of the Mariana fruit bat, the Mariana crow, the Guam rail, the Guam Micronesian kingfisher, and the Hayun lagu. The BO also concluded that the proposed action would not adversely affect critical habitat for the fruit bat, crow, and kingfisher.

In accordance with section 9 of the ESA, the BO includes an incidental take statement for the Mariana fruit bat. The USFWS anticipates that the proposed action will potentially result in the repeated incidental take of up to 30 Mariana fruit bats at Andersen AFB and Finegayan in the form of harassment leading to injury from loud aircraft noise, operation of the LFTRC, construction noise, and other human disturbance. In response to this anticipated incidental take, the BO contains additional mitigations in the form of reasonable and prudent measures, and terms and conditions for minimizing the anticipated incidental take of 30 Mariana fruit bats in the form of repeated harassment. The DON commits to all the conservation measures, BMPs, reasonable and prudent measures, and terms and conditions as expressed in the BO (section B, pages 36-46, and sections K & L pages 156-159). The BO also provides conservation recommendations to further minimize or avoid adverse impacts to listed species. At this time, DON will not be implementing any of the conservation recommendations as additional mitigation.

The DON and the USFWS entered into a MOA in June 2015 to address Guam Micronesian kingfisher conservation goals on Guam. The MOA was negotiated during the ESA section 7 consultation and also informed DON's decision for the selected alternative. In the MOA, the DON agreed to designate approximately 5,234 acres (2,118 ha) of land under the custody and control of the DoD in northern Guam to a status that will provide durable habitat protection needed to support native habitat restoration and land management for the survival and recovery of the kingfisher. Consistent with the Joint Region Marianas Integrated Natural Resources Management Plan developed in accordance with section 101 of the Sikes Act, the DON agreed to actively restore native habitat and manage, in collaboration with the USFWS, the 5,234 acres (2,118 ha) to support the reintroduction and recovery of the kingfisher. These 5,234 acres (2,118 ha) have been identified by the USFWS as habitat for the kingfisher and are necessary to offset impacts of the proposed actions. The DON and USFWS recognize that the designation of the 5,234 acres (2,118 ha) may also provide a conservation benefit to other ESA-listed species with similar habitat requirements (e.g., Mariana crow, Mariana fruit bat). This MOA became in effect upon the signing of this ROD, and commitments made within the MOA will be carried out by the DON.

On December 10, 2014, pursuant to section 7 of the ESA, the DON requested informal consultation with NMFS Pacific Islands Regional Office regarding the effects of the proposed action on ESA-listed marine species: the threatened scalloped hammerhead shark and four species of threatened coral (*Acropora globiceps*, *Acropora retusa*, *Pavona diffluens*, and *Seriatopora aculeata*). Based on further consultation with NMFS, the DON determined that only three of these recently listed coral species could occur in the vicinity of the proposed action (*Acropora globiceps*, *Acropora retusa*, and *Seriatopora aculeata*), and accordingly, the DON requested informal consultation to address potential effects to these three recently listed species. The consultation was for two separate proposed action elements, which may have the potential to affect the scalloped hammerhead shark and the three species of threatened coral identified above, and include:

- The effects of the projected increase of effluent from the Northern District WWTP outfall, a GWA facility, and
- The effects of constructing the Amphibious Vehicle Laydown Area (AVLA) in Inner Apra Harbor.

The DON determined that the projected increase of effluent from the Northern District WWTP outfall may affect, but is not likely to adversely affect *Acropora globiceps*, *Acropora retusa*, and *Seriatopora aculeata*, and the scalloped hammerhead shark because the effects are insignificant.

The AVLA includes a vehicle ramp that is the only in-water project not completed from the original 2010 EIS and associated ESA section 7 consultation with NMFS. The DON determined that the AVLA project may affect, but is not likely to adversely affect the scalloped hammerhead shark because the effects are discountable.

Consultation with NMFS concluded with a letter of concurrence on May 18, 2015 (see Appendix F.5 of the 2015 Final SEIS). NMFS agreed with the DON conclusion that the proposed action is not likely to adversely affect the scalloped hammerhead shark or the ESA-listed corals.

NMFS also agreed that the proposed action would have no effect on critical habitat. In its letter of concurrence, NMFS provided five conservation recommendations that it deemed prudent.

Magnuson-Stevens Fishery Conservation and Management Act

In accordance with the MSA, the DON initiated informal consultation with the National Oceanic and Atmospheric Administration's NMFS Pacific Islands Regional Office in May 2014 to determine the potential effects of construction and operations of DON's proposed action on EFH. Under the MSA, federal agencies are required to consult with NMFS when their actions may adversely impacts EFH. NMFS determined that adverse effects to EFH would occur unless seven recommended conservation measures are implemented to avoid and minimize impacts to EFH. The DON plans to implement six of the seven identified conservations recommendations. The seventh conservation recommendation addressing development and implementation of the Adaptive Management Plan for the watershed will be considered by DON and as appropriate individual components of the conservation recommendation may be addressed in the INRMP. The DON does not plan to implement the majority of these conservation measures. The NMFS EFH effects determination letter of April 27, 2015, containing the complete list of recommendations and the DON's response to the determination letter are located in Vol. 2, Appendix F.5 for the 2015 Final SEIS.

Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) coordination between Guam Bureau of Statistics and Plans and JRM has been completed. Pursuant to the CZMA, the DON assessed reasonably foreseeable direct and indirect effects of the proposed military relocation on Guam's defined coastal zone and resources and reviewed relevant management programs included within the Guam Coastal Management Program. The CZMA requires that federal activities that affect the coastal zone be undertaken in a manner that is consistent, to the maximum extent practicable, with the Guam Coastal Management Program's enforceable coastal policies (which include land use and environmental policies). The DON has integrated the CZMA and NEPA processes by incorporating where necessary the accepted Guam Coastal Management Program's conditions into the 2015 Final SEIS as BMPs, if they were not already addressed elsewhere as a BMP or as a mitigation measure. In accordance with provisions for phased determinations in 15 CFR § 930.36, the DON will continue to submit future project-specific determinations to the Guam Bureau of Statistics and Plans for review as design-level information becomes available.

National Historic Preservation Act

Pursuant to section 106 of the NHPA, the 2011 PA established a program alternative to govern the implementation of programs or complex project situations, particularly when potential effects to historic properties are not fully known in advance (36 CFR § 800.14(b)). The relocation action addressed in the 2010 ROD was just such a situation, given that numerous projects making up the relocation had not been defined enough to fully evaluate effects to historic properties, and a decision on the LFTRC was deferred. In order to address responsibilities under section 106 and related requirements for the relocation action, the DON consulted with the public, key agencies, and non-governmental organizations to develop a PA. These consultations resulted in execution of the 2011 PA. To ensure adequate consideration of historic preservation requirements for the relocation action, the 2011 PA was developed consistent with 36 CFR § 800.14(b)(3) as a program alternative to satisfy section 106 responsibilities, with explicit flexibility to address changes in the undertaking.

The 2011 PA includes procedures for consulting on the identification of historic properties as specific projects are developed. Data gathered during the in-fill studies conducted for the 2015 Final SEIS and information available in other previous cultural resource investigations will contribute to the review procedures in the 2011 PA. Under the 2011 PA, the DoD conducts annual reviews of proposed projects for the purpose of seeking information from the signatories, invited signatories, concurring parties, and the public regarding historic properties in project areas as part of the process for identifying historic properties and completing determinations of eligibility. Individual project reviews are conducted via a PA memo process for the purpose of soliciting additional comments regarding the DoD's determination of effect. If adverse effects are identified, DoD solicits input on its plan for resolving the adverse effects. When new information is received regarding the potential presence of historic properties, the 2011 PA outlines a process for consideration of supplemental identification measures. The 2011 PA also includes a detailed review process for avoiding, minimizing, and mitigating adverse effects specific to the construction and operation of a LFTRC on Guam, including preparation of a Training Ranges Review and Analysis (TRRA) and a RMP. Once the identification, evaluation, and determination of effect processes summarized above have been completed, the 2011 PA outlines general and project or area-specific mitigation measures. Mitigation is generally defined as taking specific steps designed to lessen the adverse effects of a DoD action on a historic property. Mitigation for adverse effects to archaeological sites includes preparation of a mitigation plan, which is submitted to the Guam SHPO for review. All mitigation work is documented in draft reports submitted to Guam SHPO for review prior to being finalized.

The DON has consulted with the parties to the 2011 PA and the public on the Draft TRRA. Consistent with the 2011 PA, the TRRA provided planning level information on potential direct and indirect effects to historic properties within areas that may be selected in the DON's ROD for the LFTRC, including the selected LFTRC alternative. The Draft TRRA includes information on the locations, orientations, and designs of each proposed LFTRC location. In addition to receipt of written comments, DON cultural resources professionals conducted three consultation sessions with the parties to the PA to discuss the analysis. The DON considered all comments in its preparation of the Final TRRA, which was published shortly after the 2015 Final SEIS. Comments and considerations developed during the Draft TRRA consultation process were incorporated in the 2015 Final SEIS and informed the Draft RMP, which is currently undergoing consultation with the PA Parties. The RMP will be finalized based on this ROD.

National Wildlife Refuge System Administration Act

The Ritidian Unit of the Guam NWR is managed by the USFWS and under its custody and control. As discussed above, under the authority provided in Section 2822 of the FY 2015 NDAA, the DON will pursue an agreement with the USFWS to establish and operate a surface danger zone that overlays portions of the Ritidian Unit. The agreement will allow for the continued management of the Ritidian Unit consistent with the purposes for which it was established.

RESPONSES TO COMMENTS RECEIVED ON THE 2015 FINAL SEIS: The DON reviewed and considered all comments that were received during the 30-day waiting period, initiated with publication of the 2015 Final SEIS NOA (80 FR 42491) on July 17, 2015. Two comment letters were received—one from the GPT containing 7 comments and the other from the EPA Region 9 containing 16 comments. No additional mitigation measures are required as a result of comments on the Final SEIS. Following is a summary of the comments received from the GPT and EPA, many of which were received on the Draft SEIS.

GPT – All of the comments received from the GPT are covered in the 2015 Final SEIS. Specific comments from GPT included:

- Continued strong opposition to any LFTRC location on Guam; supports providing input to the RMP;
- Observed that DoD has shown a "greater expression to show sensitivity towards cultural resources";
- Concerned about limestone forest impacts and that impacts be mitigated in the RMP
- Advocates for public access to cultural sites and an agreement between DoI and DoD to mitigate access impacts;
- Recommends funding public education, outreach and awareness to address cultural resource impacts and loss;
- Agrees with 2015 Final SEIS mitigation to fund a cultural repository; and
- Looks forward to partnering with DoD to promote historic preservation and awareness in Guam.

The DON commits continued coordination and partnership with the GPT as a Concurring Party to the 2011 PA and the RMP to adequately address impacts associated cultural resource protection and mitigation. The DON will update GPT and other parties to the 2011 PA on DOI-DoD progress establishing Guam NWR Agreement in accordance with section 2822 of the 2015 NDAA and associated cultural resources management (including access), continued development of information on cultural resources in accordance with 2011 PA and RMP, and strive to secure authorization for construction of a Cultural Repository.

EPA – All of the comments received from EPA are covered in the 2015 Final SEIS. Specific comments from EPA included:

- Appreciates DoD support for the EAC Implementation Plan;
    - Appreciates DoD efforts to obtain funding for GWA wastewater system;
- Provided Recommendations for ROD;
    - Provide DoD funding for hydrologic data collection network improvements, monitoring for 10 years and to support the GWRDG;
    - Specify the stringency of DoD's Range Environmental Vulnerability Assessment (REVA) and Operational Range Clearance Programs, the receptors to be evaluated and

CONCLUSION:

After careful consideration of the purpose and need for the proposed action, the analysis contained in the 2015 Final SEIS, and comments received on the Draft and Final SEIS from federal agencies, Guam agencies, non-governmental organizations and the public, mitigation and other factors discussed above, the DON has decided to proceed with implementation of the preferred alternatives as identified in the 2015 Final SEIS: Alternative E for the cantonment/family housing component and Alternative 5 for the LFTRC component of the proposed action, with mitigation as described in this ROD. The LFTRC also includes a stand-alone hand grenade range at Andersen South. In addition, the exact configuration of the SUA associated with this alternative is subject to ongoing actions between DoD and the FAA. The preferred alternatives best meet current and future military training requirements on Guam.

The proposed action and selected alternatives differ significantly from those analyzed in the 2010 Final EIS and addressed in the 2010 ROD in a number of important ways. In addition to the significantly reduced number of Marines and their dependents relocating to Guam, the proposed action selected in this ROD will be implemented at a more gradual pace over 13 years compared to 7 years for the original proposed action considered in the 2010 ROD thus avoiding short-term population and construction tempo peaks and associated environmental impacts. Construction of the cantonment at Finegayan will impact approximately 850 fewer acres than was projected in 2010 and, unlike 2010, the cantonment, family housing and LFTRC construction will occur only on land currently under the custody and control of the DoD. The selected cantonment alternative maintains a natural buffer area between developed areas and nearby sensitive coastal resources and, by placing the family housing at AAFB, leverages the availability of an existing family housing area and supporting infrastructure at AAFB.

9/28/15

Date

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Principal Deputy Assistant Secretary of the Navy (Energy, Installations and Environment)

Prepared Under
Contract Number N62742-11-D-1801
Delivery Order No: 0011

FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT (SEIS)

Lead Agency:	Department of the Navy
Cooperating Agencies:	Federal Aviation Administration; Federal Highway Administration; U.S. Department of the Air Force; U.S. Department of Agriculture; U.S. Department of the Interior, Office of Insular Affairs; U.S. Environmental Protection Agency, Region 9
Title of Proposed Action:	Guam and Commonwealth of the Northern Mariana Islands Military Relocation (2012 Roadmap Adjustments)
Affected Jurisdictions:	Guam
Designation:	Final SEIS

Abstract

In September 2010, the United States (U.S.) Department of the Navy (DON) signed a Record of Decision (ROD) regarding the 2010 Final Environmental Impact Statement (EIS) for the *Guam and CNMI Military Relocation*. In April 2012, the U.S.-Japan Security Consultative Committee jointly announced an adjustment to the previous plans for the Guam military relocation. In accordance with these "2012 Roadmap Adjustments," the Department of Defense (DoD) adopted a new force posture in the Pacific providing for a materially smaller and reconfigured Marine Corps force on Guam.

Pursuant to the National Environmental Policy Act (NEPA) and the Council on Environmental Quality's implementing regulations for NEPA, the DON prepared this Final SEIS for the purpose of supplementing the portions of the 2010 Final EIS regarding the establishment on Guam of a live-fire training range complex (LFTRC), a cantonment area, a family housing area, and associated infrastructure to support the relocation of a substantially reduced number of Marines and dependents than was previously analyzed. By supplementing the 2010 Final EIS, this Final Supplemental EIS (SEIS) advances NEPA's purpose of informing decision-makers and the public about the environmental effects of the DON's proposed action.

The following federal agencies, having either jurisdiction or technical expertise for certain components of the proposed action or a potentially affected resource, have accepted the DON's invitation to participate as cooperating agencies: U.S. Air Force, Federal Aviation Administration, Federal Highway Administration, U.S. Environmental Protection Agency Region 9, U.S. Department of Interior - Office of Insular Affairs, and U.S. Department of Agriculture.

This Final SEIS analyzes the potential environmental impacts of five action alternatives for the cantonment/family housing component of the proposed action and five action alternatives for the LFTRC component, plus a no-action alternative. Potential impacts have been analyzed for geological and soil resources, water resources, air quality, noise, airspace, land and submerged land use, recreational resources, terrestrial biological resources, marine biological resources, cultural resources, visual resources, ground transportation, marine transportation, utilities, socioeconomics and general services, hazardous materials and waste, public health and safety, and environmental justice.

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July 2015

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EXECUTIVE SUMMARY

ES-1 INTRODUCTION

In September 2010, the United States (U.S.) Department of the Navy (DON) signed a Record of Decision (ROD) (77 Federal Register [FR] 60438, September 30, 2010) regarding the 2010 Final Environmental Impact Statement (EIS) for the *Guam and Commonwealth of the Northern Mariana Islands (CNMI) Military Relocation; Relocating Marines from Okinawa, Visiting Aircraft Carrier Berthing, and Army Air and Missile Defense Task Force* (DON 2010). The ROD documented the DON's decision to implement the preferred alternatives identified in the 2010 Final EIS for the main base (cantonment), aviation, and waterfront operations to support relocation of approximately 8,600 Marines and approximately 9,000 dependents from Okinawa to Guam. The ROD deferred a decision on the development of a live-fire training range complex (LFTRC) along Route 15 in the northeastern part of Guam.

In the months following issuance of the ROD, the DON formally committed that if the Route 15A area was selected for the LFTRC, the DON would provide for 24 hours a day, 7 days a week access to Pågat Village and Pågat Cave historical sites, to include the existing trail from Route 15A leading to both (DON 2011; Department of Defense [DoD] 2011). The DON, to meet this commitment, applied a probabilistic methodology to more precisely model the size of the surface danger zone (SDZ) associated with the Multi-Purpose Machine Gun (MPMG) Range, which would be part of the LFTRC. Application of this methodology reduced the size of the overall footprint and enabled the DON to take another look at potential LFTRC locations on Guam, including those locations previously considered but not carried forward for detailed analysis. This reevaluation resulted in the identification of additional LFTRC preliminary alternatives. In light of this information, the DON initially elected to prepare a Supplemental Environmental Impact Statement (SEIS) limited solely to the evaluation of potential impacts associated with the construction and operation of an LFTRC on Guam (hereinafter "LFTRC SEIS"). The DON issued a Notice of Intent (NOI) to prepare the LFTRC SEIS in February 2012 (77 FR 6787, February 9, 2012) and held public scoping meetings on Guam in March 2012.

On April 27, 2012, the U.S.-Japan Security Consultative Committee issued a joint statement announcing its decision to adjust the plans outlined in the May 2006 Roadmap for Realignment Implementation. In accordance with these "2012 Roadmap Adjustments," the DoD adopted a new force posture in the Pacific providing for a materially smaller and reconfigured force on Guam. In conjunction with changes to the mix of personnel involved in the relocation, the force adjustments would reduce the originally planned relocation of approximately 8,600 Marines with 9,000 dependents to a force of approximately 5,000 Marines with approximately 1,300 dependents. That decision prompted the DON's review of the actions previously planned for Guam and approved in the September 2010 ROD. This review concluded that while some actions remained unchanged, others, such as the size and location of the cantonment and family housing areas, could significantly change as a result of the modified force. Therefore, the DON published a new NOI (77 FR 61746, October 11, 2012) and amended the scope of the ongoing LFTRC SEIS to add those actions that materially changed as a result of the new force posture. The DON conducted additional public scoping meetings for this expanded SEIS in November 2012.

The DON prepared this SEIS in accordance with the National Environmental Policy Act (NEPA) (42 U.S. Code [USC] §§ 4321, *et seq.)* and the Council on Environmental Quality's (CEQ's) implementing regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508). Pursuant to 40 CFR § 1502.9, the DON prepared this SEIS for the purpose of supplementing the portions of the 2010 Final EIS regarding the establishment on Guam of a cantonment area, family housing, an LFTRC, and associated

infrastructure to support the relocation of a substantially reduced number of Marines and dependents than was previously analyzed. By supplementing the 2010 Final EIS, the SEIS advances NEPA's purpose of informing decision-makers and the public about the environmental effects of the DON's proposed action.

The proposed change in size and composition of the new force structure under the 2012 Roadmap Adjustments and the reconsideration of the LFTRC SDZ footprint did not affect all of the decisions made in the September 2010 ROD. For example, the location of Aviation Combat Element (ACE) facilities, the air embarkation facilities (Air Mobility Command Complex), the development of the North Gate and access road at Andersen Air Force Base (AAFB), the wharf improvements at the U.S. Navy (hereinafter "Navy") base at Apra Harbor, and the non-live fire and maneuver training ranges on Andersen South remain unaffected by the changes in force structure resulting from the April 2012 Roadmap Adjustments. For those decisions that are not affected by the new force structure, the September 2010 ROD stands as the final agency action for those actions. The expanded scope of this SEIS does not include the transient aircraft carrier berthing in Apra Harbor or the U.S. Army (hereinafter "Army") Air and Missile Defense Task Force deployment that were addressed in the 2010 Final EIS. The disposition of those projects is independent of the SEIS proposed action.

ES-2 PURPOSE AND NEED

The purpose of the proposed action evaluated in this SEIS is to ensure that the relocated Marines are organized, trained, and equipped as mandated by 10 USC § 5063, to satisfy individual live-fire training requirements as described in the 2010 Final EIS and associated ROD, and to establish an operational U.S. Marine Corps (hereinafter "Marine Corps") presence on Guam in accordance with the 2012 Roadmap Adjustments. The purpose remains unchanged from the 2010 Final EIS, albeit to support a materially smaller relocating Marine Corps force.

The proposed action is needed to ensure consistency with the new force posture adopted by the DoD in accordance with the April 2012 Roadmap Adjustments, which provide for a materially smaller force on Guam than was originally proposed in the 2010 Final EIS, while fulfilling U.S. national security obligations to provide mutual defense, deter aggression, and dissuade coercion in the Western Pacific Region.

ES-3 PROPOSED ACTION

The proposed action is to construct and operate a cantonment area, family housing, and an LFTRC on Guam to support the Marine Corps relocation. To meet the purpose of and need for the proposed action, the Marine Corps requires facilities that can fully support the missions of the relocated units. These requirements include a cantonment area, family housing and community support facilities of sufficient size and functional organization to accommodate the reduced and reconfigured number of Marines relocating to Guam per the 2012 Roadmap Adjustments, and an LFTRC that allows for simultaneous use of firing ranges to support individual skills training and related operations of the relocated Marines. The proposed action also includes the provision of on-site utilities, access roads, and related off-site infrastructure to support the proposed cantonment/family housing and LFTRC. The DON's preferred alternative is to construct and operate the proposed cantonment at the Naval Base Guam, Telecommunications Site at Finegayan (hereinafter "Finegayan"), the proposed family housing on AAFB, and the proposed LFTRC at Northwest Field (NWF) on AAFB (see Section ES-6 Preferred Alternative for more information). The chart below highlights some of the key differences between the 2010 Final EIS and this SEIS.

Key Differences Between 2010 Final EIS and 2015 Final SEIS

2010 Final EIS		2015 Final SEIS
Approximately 8,600 Marines and 9,000 dependents relocating over 5 years	**Relocated Population**	Approximately 5,000 Marines and 1,300 dependents relocating over 12 years
7-year intense construction boom followed by sharp decline	**Construction Period**	13-years of moderate construction activity with gradual phase out
More than 79,000 new Guam residents at peak	**Peak Population Increase**	Less than 10,000 new Guam residents at peak
More than 33,000 additional Guam residents	**Steady State Population Increase**	Approximately 7,400 additional Guam residents
2,580 acres at Finegayan preferred alternative	**Project Area: Cantonment**	1,723 acres at Finegayan/AAFB preferred alternative
Acquisition of 688 acres of non-federal land at Finegayan preferred alternative	**Land Acquisition: Cantonment**	No land acquisition at Finegayan/AAFB preferred alternative
5,529 acres for Route 15 preferred alternative (4,439 acres in SDZs, mostly over ocean)	**Project Area: LFTRC**	3,957 acres for Northwest Field preferred alternative (3,701 acres in SDZs, mostly over ocean)
Acquisition of more than 1,000 acres of non-federal land at Route 15 preferred alternative	**Land Acquisition: LFTRC**	No land acquisition at Northwest Field preferred alternative
20 megawatts	**Power Demand**	5.7 megawatts
5.82 million gallons/day	**Potable Water Demand**	1.7 million gallons/day
2.6 million gallons/day	**Wastewater Generation**	1.2 million gallons/day
165,600 pounds/day	**Solid Waste Generation**	54,250 pounds/day
4 alternative sites in EIS analysis, all in same vicinity	**EIS Alternatives: Cantonment**	5 alternative sites in 3 different areas on Guam
2 alternative sites in EIS analysis, both in same vicinity	**EIS Alternatives: LFTRC**	5 alternative sites in 3 different areas on Guam

ES-3.1 RELOCATION OF MARINES AND ASSOCIATED POPULATION CHANGE

The proposed Marine Corps relocation to implement the 2012 Roadmap Adjustments would consist of approximately 5,000 Marines accompanied by approximately 1,300 dependents, a 64% reduction in the relocated Marine Corps population compared to the proposed relocation in the 2010 Final EIS. The direct population influx associated with Marine Corps uniformed personnel would be supplemented by civilian military workers and off-island construction workers, as well as indirect and induced population that would be associated with economic growth from the proposed action (along with dependents for each). Figure ES-1 compares the population increase associated with the current proposed action to the increase that was projected in the 2010 Final EIS. The analysis of population growth in the 2010 Final EIS showed a rapid increase in the first 5 years of the relocation, a peak, and then a sharp decline to a steady state population increase of more than 33,000 new residents compared to the baseline population. The sharp increase and decline were forecast because the original planned construction period was intense and extremely short (which would have required the influx and subsequent outflow of large numbers of off-island construction workers over a relatively short period), and would have coincided with the arrival of Marines and their families.

The proposed action for the SEIS includes a relatively longer and more gradual construction period (13 years compared to 7 years for the 2010 Final EIS), resulting in a smaller requirement to bring off-island construction workers. This extended construction period and reduced number of relocated personnel are forecast to generate a much smaller and more gradual overall increase in population, rather than a peak, as shown in Figure ES-1. The eventual steady state (post construction) increase in island population related to the current proposed action would be approximately 7,400 additional Guam residents, a 78% reduction compared to the steady state population increase described in the 2010 Final EIS.

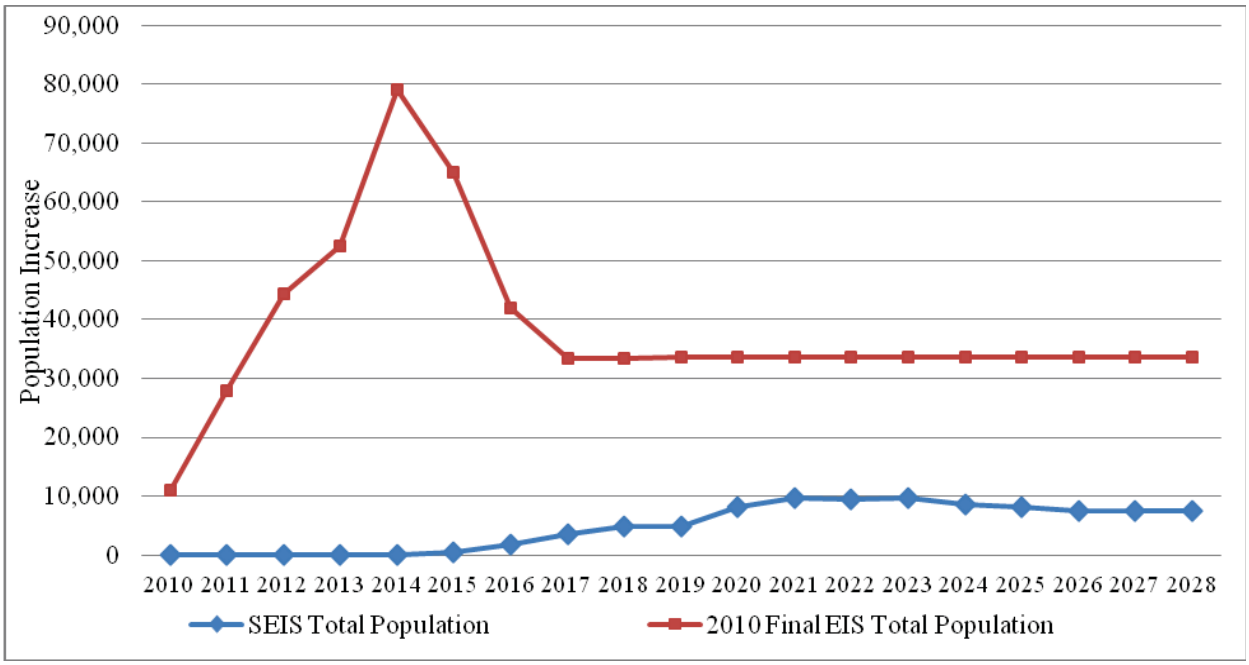


Figure ES-1 Comparison of Project-Related Population Increase on Guam: 2010 Final EIS and 2012 Roadmap Adjustments SEIS

ES-3.2 CANTONMENT AND FAMILY HOUSING

This component of the proposed action includes construction and operation of essential headquarters and administrative support facilities; base operations; supply, service, maintenance, and other support functions; housing for unaccompanied and accompanied personnel; and on base roadways, utilities, and similar infrastructure. These categories of facilities and functions are consistent with those included in the proposed action for the 2010 Final EIS, but the relative size and scope of the cantonment area is considerably reduced in the SEIS proposed action given the reduced size and adjusted composition of the relocating force. For example, the development footprint of the cantonment/family housing area that was selected in the 2010 ROD (which also represents the No-Action Alternative in this SEIS) is almost 78% larger than a representative SEIS alternative at Finegayan (Figure ES-2).

In addition to proposed construction of the various facilities and functions within the cantonment/family housing, the proposed action also includes expansion of the DoD Education Activity High School located at the Naval Hospital site on central Guam, and either expansion or (in the case of the alternative at AAFB) repurposing and replacement of the existing Andersen Middle School on AAFB.

ES-3.3 LIVE-FIRE TRAINING RANGE COMPLEX

This component of the proposed action includes the construction and operation of five live-fire training ranges and associated range operation and control facilities and access roads at a single consolidated location to meet the individual weapons training/qualification requirements of the relocating Marine Corps force. It also includes construction and operation of a stand-alone Hand Grenade (HG) Range at a single location on federally-owned land at Andersen South and U.S. Fish and Wildlife Service (USFWS) replacement facilties (including new beach access) within the Ritidian Unit of the Guam National Wildlife Refuge (NWR). The characteristics (though not the specific layout or footprint) of all proposed training ranges are consistent with the descriptions contained in the 2010 Final EIS, with the exception of a revised probabilistic SDZ configuration for the largest range in the LFTRC (i.e., the MPMG Range) and updated estimates of range utilization and ammunition usage.

Each range in the proposed LFTRC is designed to meet different training requirements. The usage of each individual range would primarily be dependent upon the number of individuals requiring training on the associated weapon system and the frequency of training required by appropriate training directives. The LFTRC utilization analyzed in this SEIS is up to 39 weeks (273 days) per year, with the remaining 13 weeks of the year unavailable for training due to weather, range maintenance, and holidays. However, each individual range is anticipated to be used less than the entire LFTRC's planned total of 39 weeks. Training at the LFTRC would typically occur during weekdays but periodic weekend use could also occur as needed.

The estimated annual ammunition usage at the LFTRC under the 2012 Roadmap Adjustments would be approximately 47% less than the amount analyzed in the 2010 Final EIS. This reduction would result from the changed composition and reduced numbers of Marine Corps personnel that would be relocated to Guam.

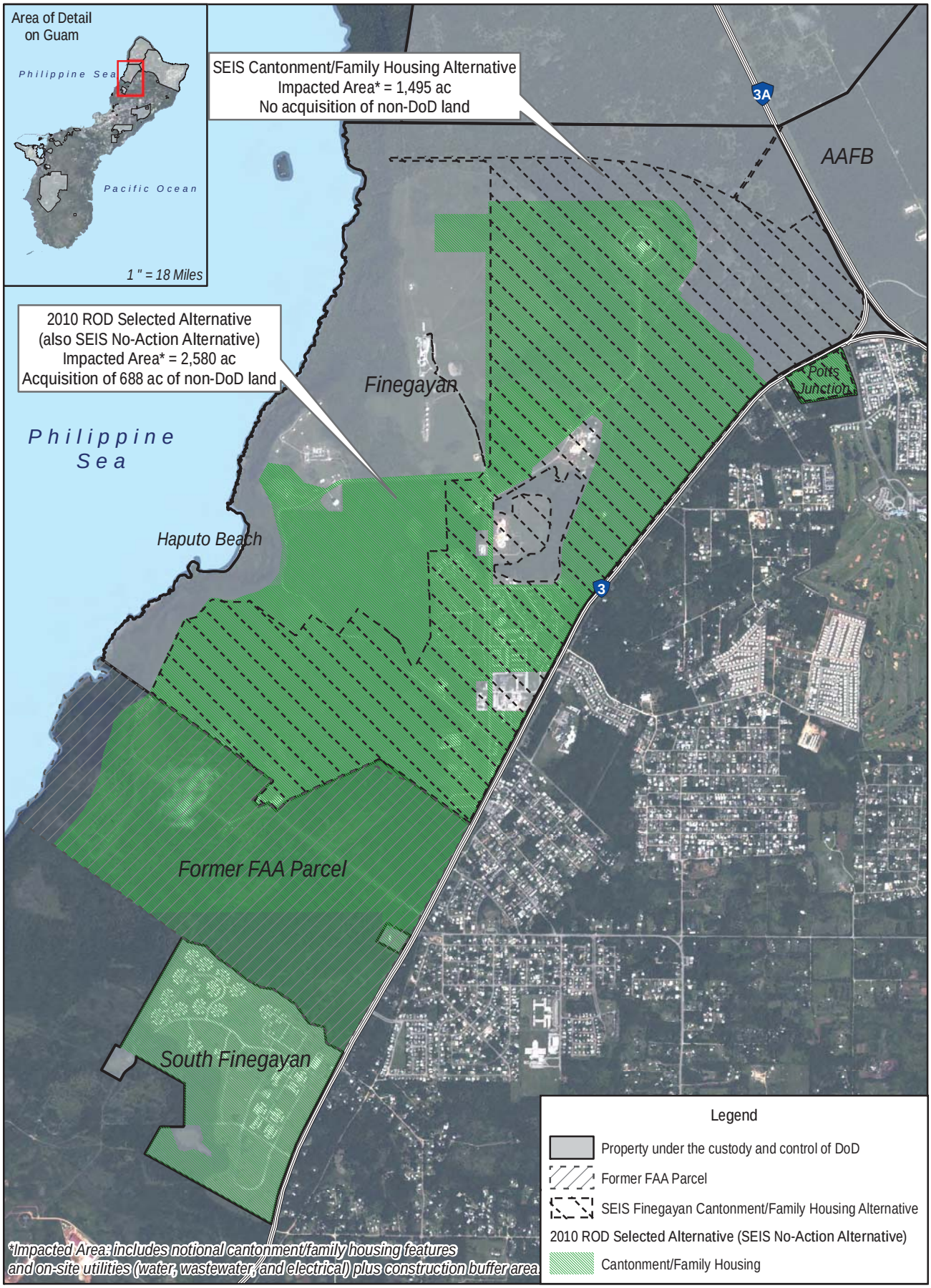


Figure ES-2
Comparison of an SEIS Cantonment/Family Housing Alternative to the Alternative Selected in the 2010 ROD

ES-3.4 UTILITIES AND INFRASTRUCTURE

The DON updated the utilities assessment studies prepared for the 2010 Final EIS to reflect the reduced Marine Corps population and reduced facilities requirements associated with the 2012 Roadmap Adjustments. The updated studies focused on power, potable water, wastewater, and solid waste disposal, and the DON conducted a new evaluation for information technology and communications (IT/COMM) requirements. The studies factored in the anticipated increase in population and associated utility demand, including direct, indirect, induced, and natural growth. Utilities requirements for the proposed action include: (1) on-site DoD utilities to support the cantonment, family housing, and LFTRC facilities under each project alternative; (2) off-site DoD utilities required to connect the proposed facilities to existing military and civilian utilities infrastructure; and (3) upgrade or augmentation of existing military and civilian utilities infrastructure where necessary and appropriate to support the relocation.

ES-4 ALTERNATIVES CONSIDERED

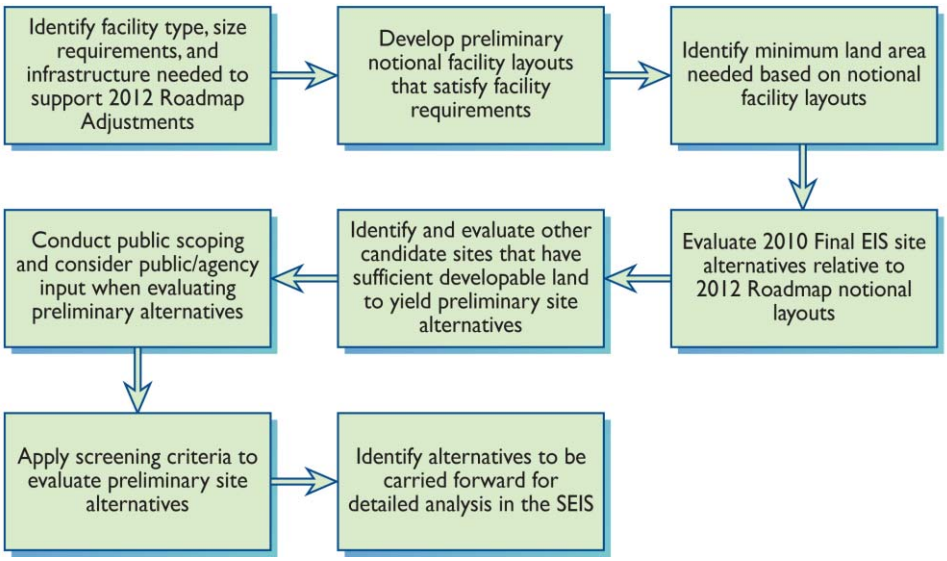
ES-4.1 ALTERNATIVES DEVELOPMENT METHODOLOGY

Because of the reduced acreage requirements for the cantonment and family housing facilities, as well as other factors (e.g., the reconfigured SDZ footprint for the proposed LFTRC, consideration of public input, refinement of range designs, criteria changes, and a reassessment of operational requirements, conflicts, and opportunities), the DON considered a broad range of siting alternatives in this SEIS. Some of these siting alternatives were not feasible under the conditions evaluated in the 2010 Final EIS but were reconsidered for the 2012 Roadmap Adjustments SEIS.

For the SEIS, the DON applied a methodology for identifying and evaluating alternatives that was similar to the one described in the 2010 Final EIS. This methodology included the identification of preliminary alternatives based on a search for land areas on Guam that are large enough to accommodate the proposed cantonment/family housing and the application of appropriate screening criteria to represent the essential operational and mission requirements of the relocating forces. The DON derived initial screening criteria from the "Marine Corps Guam Cantonment Guiding Principles" (hereinafter "Guiding Principles") developed at Headquarters Marine Corps for the planning and establishment of Marine Corps Base Guam. Additional screening criteria were derived from input provided by the Chief of Staff of the U.S. Air Force (hereinafter "Air Force") and Commander, Navy Installations Command (CNIC). All screening criteria are described in detail in Section 2.3 of the SEIS.

Based on the Guiding Principles, and in consideration of Air Force and CNIC input, the DON developed a two-step screening process for evaluating potential alternatives using the initial screening criteria and additional screening criteria. Initial screening criteria represented fundamental requirements that must be met for an alternative to be considered for further analysis. Alternatives that satisfied the initial screening criteria were subsequently evaluated qualitatively in terms of their strengths and weaknesses relative to a defined set of additional screening criteria (e.g., mission impacts or proximity to compatible functions). The DON developed separate sets of screening criteria for the cantonment, family housing, and LFTRC components of the proposed action.

The flowchart outlines the alternatives development process that was followed for this SEIS.



ES-4.1.1 Evaluation of Preliminary Cantonment/Family Housing Alternatives

The DON first applied this methodology for considering alternatives to evaluate an initial set of four preliminary site alternatives for the cantonment[1] and a set of five preliminary site alternatives for family housing and associated facilities.[2] After considering the Guiding Principles, the DON consolidated these preliminary alternatives into five combined cantonment/family housing preliminary alternatives for purposes of public scoping. The five preliminary alternatives for cantonment/family housing were:

- Finegayan Cantonment/Family Housing
- Finegayan Cantonment/South Finegayan Family Housing
- AAFB Cantonment/Family Housing
- Barrigada Cantonment/Family Housing
- Apra Harbor Cantonment/Family Housing

All five of these preliminary alternatives are located on property that is under the custody and control of the DoD.

Despite some partial commonality and overlap with the site layouts analyzed in the 2010 Final EIS, the first two preliminary site alternatives listed above (involving Finegayan and South Finegayan) differ substantially from those previous alternatives. The preliminary alternatives above would require a substantially smaller development footprint than was analyzed in the 2010 Final EIS, and would not require the use of the adjacent former Federal Aviation Administration (FAA) parcel (see Figure ES-2).

[1] Finegayan, AAFB, Barrigada, and Apra Harbor.
[2] Finegayan, South Finegayan, AAFB, Barrigada, and Apra Harbor

ES-4.1.2 Evaluation of Preliminary LFTRC Alternatives

A similar approach was used to identify preliminary site alternatives for the LFTRC on Guam, except that an associated acreage requirement was not developed for the LFTRC because the footprint would be dependent on specific site conditions. The land area required would need to include the space for the range facilities (including firing points, berms, and impact areas) and associated SDZs. The quantity and quality of land that would need to be acquired and the current ownership of such land were also considered in the evaluation. The DON first reviewed previous LFTRC alternatives that had been considered and eliminated in the 2010 Final EIS to determine if any of those sites could be considered a reasonable alternative following application of the probabilistic methodology for a site-specific range SDZ layout. As a result of this review, the DON identified five preliminary alternatives for the range complex: two adjacent to Route 15 in northeastern Guam, and three located at or immediately adjacent to the Naval Magazine (NAVMAG) area.

Comments received during scoping for the LFTRC SEIS (February-April 2012) suggested that the DON should also consider NWF at AAFB as an alternative location for the LFTRC. Although the DON had previously analyzed and dismissed NWF as a potential LFTRC alternative primarily due to operational conflicts, the DON worked with the Air Force to develop a NWF LFTRC alternative. The proposed NWF alternative does not eliminate all operational and environmental challenges; however, as presented in this SEIS it is a reasonable alternative based on the screening criteria defined for the LFTRC. In addition, because cantonment/family housing alternatives other than Finegayan are now being considered (see Section 2.4), a potential LFTRC alternative at Finegayan was also developed that merited further consideration. As a result, the DON identified seven preliminary alternatives for the LFTRC for purposes of public scoping for this SEIS. The seven preliminary alternatives for the proposed LFTRC were:

- Route 15A
- Route 15B
- NAVMAG (East/West)
- NAVMAG (North/South)
- NAVMAG (L-Shaped)
- NWF
- Finegayan

ES-4.2 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the DON would continue to implement the September 2010 Final EIS and ROD. The decision to construct and operate the LFTRC would remain deferred, and the DON would establish a cantonment/family housing area for a larger force of approximately 8,600 Marines and approximately 9,000 dependents on federally-controlled lands at Finegayan and South Finegayan and by acquiring land known as the former FAA parcel. The No-Action Alternative is not a reasonable alternative as it would not meet the purpose and need for the proposed action as defined above. Foremost, it would be inconsistent with the new force posture adopted by the DoD in accordance with the April 27, 2012 Roadmap Adjustments, which provide for a materially smaller relocated force on Guam. Furthermore, the No-Action Alternative would neither satisfy the training requirements for the relocated Marines as mandated by 10 USC § 5063 nor satisfy the individual live-fire training requirements as described in the 2010 Final EIS and ROD. Although the No-Action Alternative presumes the present course of action identified in the September 2010 ROD, for purposes of assessing the environmental impacts of the proposed alternatives in this SEIS, the DON compared the impacts of the proposed action

to the baseline conditions identified in the July 2010 Final EIS. The DON updated baseline conditions, as appropriate, based upon the availability of new information.

ES-4.3 ALTERNATIVES CONSIDERED BUT DISMISSED

The DON's objective in applying the alternatives development process was to systematically identify and evaluate the reasonable action alternatives that would be carried forward for NEPA analysis. For the purposes of this SEIS, an alternative was considered reasonable if it would satisfy the purpose of and need of the proposed action and was practical and feasible from both a technical and economic standpoint. After a thorough evaluation of each preliminary alternative relative to the defined screening criteria, the DON eliminated Apra Harbor as a preliminary cantonment/family housing alternative and both Route 15B and Finegayan as preliminary LFTRC alternatives. These alternatives were not deemed reasonable because they did not satisfy the screening criteria identified by the Marine Corps, Air Force, and CNIC. The DON recognizes that not carrying forward the Route 15B preliminary LFTRC alternative presents an apparent inconsistency with the 2010 Final EIS. Coordination with the FAA during the development of this SEIS resulted in the determination that potential airspace impacts associated with the Route 15B preliminary alternative could not be mitigated. Sections 2.4.2 and 2.5.2 of the SEIS describe in more detail (for cantonment/family housing and LFTRC alternatives, respectively) why specific preliminary alternatives were eliminated from further analysis.

ES-4.4 ALTERNATIVES CARRIED FORWARD FOR ANALYSIS IN THE SEIS

Figure ES-3 shows the five cantonment/family housing alternatives that are analyzed in this SEIS:

- Alternative A – Finegayan Cantonment/Family Housing
- Alternative B – Finegayan Cantonment/South Finegayan Family Housing
- Alternative C – AAFB Cantonment/Family Housing
- Alternative D – Barrigada Cantonment/Family Housing
- Alternative E – Finegayan Cantonment/AAFB Family Housing[3]

Section 2.4.4 of the SEIS describes each cantonment/family housing alternative in more detail. Each of the alternatives includes development of associated off-site utilities and modifications at two existing DoD schools. All five alternatives involve land parcels that are already under the custody and control of the federal government, and therefore no acquisition of non-federal lands would be required. In addition, two of the proposed alternatives are in locations on Guam other than Finegayan and one alternative is only partially located on Finegayan. In comparison, the 2010 Final EIS evaluated four site alternatives for cantonment that all involved the use of Finegayan (as well as various combinations of non-contiguous parcels to accommodate family housing) and three of the four required the acquisition of non-federal land.

As per CEQ regulations, the DON also analyzed a No-Action Alternative in this SEIS, which as described in Section ES-4.2 would involve development of the cantonment/family housing alternative that was selected in the 2010 ROD.

Figure ES-4 shows the following five LFTRC alternatives that are analyzed in this SEIS:

- Alternative 1 – Route 15
- Alternative 2 – NAVMAG East/West

[3] Alternative E – Finegayan Cantonment/AAFB Family Housing was added after publication of the Draft SEIS and review of public comments. A full explanation is provided in Section ES-6 and Section 2.7 of the Final SEIS.

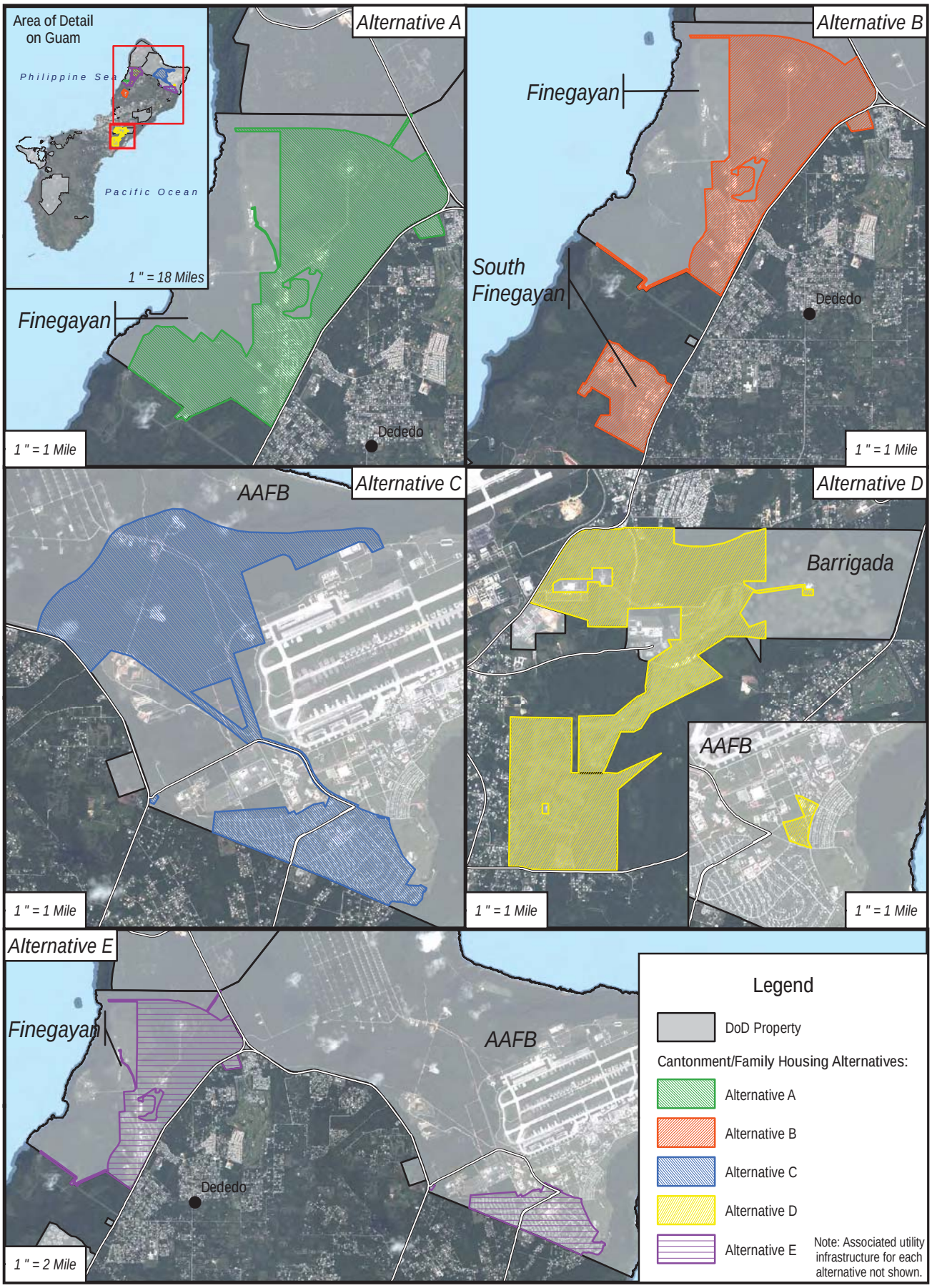


Figure ES-3
Cantonment/Family Housing Alternatives
Carried Forward for Analysis

Source: NAVFAC Pacific 2013

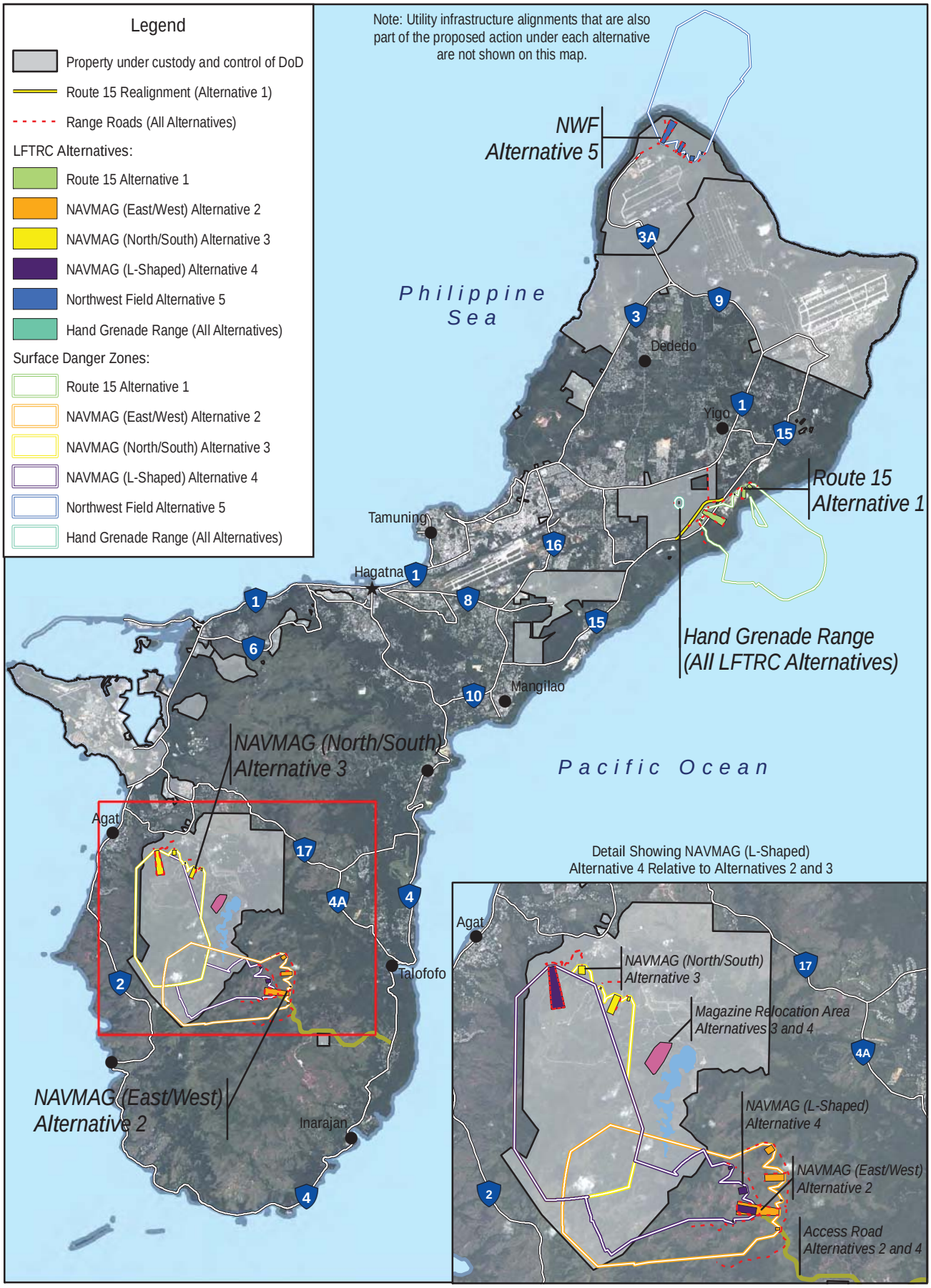


Figure ES-4
SEIS Live-Fire Training Range Complex Alternatives

Source: NAVFAC Pacific 2013

- Alternative 3 – NAVMAG North/South
- Alternative 4 – NAVMAG L-Shaped
- Alternative 5 – NWF

Section 2.5.4 of the SEIS describes each of the LFTRC alternatives in more detail. All of the alternatives include a proposed stand-alone HG Range location at Andersen South. Alternative 1 is similar to the Route 15A alternative studied in the 2010 Final EIS, except that it now avoids encumbering public access to the Pågat Village and Pågat Cave historical sites and the existing trail from Route 15 leading to both. The remaining four LFTRC alternative sites were not evaluated in the 2010 Final EIS. Of the five LFTRC alternatives, only the alternative at NWF can be implemented without acquisition of additional non-federal land. The alternative at NWF is also unique because it would include the relocation of USFWS facilities within the Ritidian Unit of the Guam NWR that would otherwise be encumbered by the proposed range SDZs.

ES-4.4.1 Comparison of Cantonment/Family Housing Alternatives

Table ES-1 provides a comparison of the land area involved for each cantonment/family housing alternative and for the No-Action Alternative. The potentially impacted area for the cantonment (not including off-site utilities and school expansions/construction) varies from 1,074 acres (435 hectares [ha]) at Barrigada (Alternative D) to 1,309 acres (530 ha) at AAFB (Alternative C). The potentially impacted area for the proposed family housing varies from 115 acres (47 ha) at Barrigada (Alternative D) to 510 acres (206 ha) at AAFB (Alternative C or E). As shown in the table, any of the five SEIS alternatives for cantonment and family housing require substantially less acreage than the No-Action Alternative. For all alternatives, additional areas would be impacted by implementation of off-site utilities specific to each cantonment/family housing alternative, and the school expansions or construction (except for the No-Action Alternative, for which no DoD school construction was identified). Estimates of the area potentially affected, especially for off-site utilities, are worst case estimates that reflect the current lack of detail in the exact placement of underground utility lines (in most instances a 50-foot (15-meter) wide corridor has been assumed even though the eventual ground disturbance may be only a few feet wide).

Table ES-1. Summary Comparison of Land Area Potentially Impacted by Cantonment/Family Housing Alternatives (acres / ha)

	Finegayan Alternative A	***Finegayan/South Finegayan Alternative B***	***AAFB Alternative C***	***Barrigada Alternative D***	***Finegayan/ AAFB Alternative E***	***No-Action Alternative [1]***
Cantonment[2]	1,165 / 471	1,191 / 482	1,309 / 530	1,074 / 435	1,213 / 491	2,580 / 1,044
Family Housing Area[3]	330 / 134	290 / 117	510 / 206	115 / 47	510 / 206	
Offsite Utilities[4, 5]	30 / 12	42 / 17	21 / 8	90 / 36	48 / 19	188 / 76
Utilities - Electric and Water Lines	107 / 43	81 / 33	117 / 47	86 / 35	105 /42	not reported
Utilities - Water Well Area	45 / 18	45 / 18	45 / 18	45 / 18	45 / 18	not reported
School Expansion/ Construction	17 / 7	17 / 7	28 / 11	17 / 7	28 / 11	0/0
Total Area	**1,694 / 686**	**1,666 / 674**	**2,030 / 817**	**1,427 / 557**	**1,949 / 789**	**2,768 / 1,120**

Notes: [1]As defined by Alternative 2 selected in the 2010 ROD. Cantonment and housing area acreages are combined for the No-Action Alternative.
[2]The differences in cantonment acreage between Alternatives A, B, and E are due to differences in utility configuration.
[3]The size of the impacted area for constructing housing under either Alternative C or E is larger than for other alternatives because of the need to replace 912 existing family housing units in addition to new units for relocating Marines.
[4]Not including IT/COMM lines between specific combinations of a cantonment/family housing alternative and an LFTRC Alternative, which are described in Section 2.6. Assumes a worst-case corridor of potential impact for underground utility lines whose precise location has not yet been determined. Actual area of impact along the underground lines is likely to be much less than acreages estimated here.
[5]Acreage of off-site utilities were not reported in the 2010 Final EIS; however, for purposes of this comparison, it is conservatively assumed that the acreage for the No-Action Alternative would be the same as the SEIS alternatives.

ES-4.4.2 Comparison of LFTRC Alternatives

The five LFTRC alternatives would require between 3,572 acres (1,446 ha) for NAVMAG (North/South) Alternative 3 and 4,918 acres (1,990 ha) for NAVMAG (L-Shaped) Alternative 4. This includes the construction footprint for the ranges and associated facilities; the additional SDZ area required that would not be impacted by construction, including lands and submerged lands; the stand-alone HG Range proposed at Andersen South; and the access roads required for Alternatives 2, 4, and 5. Table ES-2 provides a comparison of the land area required for each LFTRC alternative. Table ES-3 provides a summary comparison of non-federal land acquisition requirements for each LFTRC alternative.

Table ES-2. Summary Comparison of Land Area Included in LFTRC Alternatives (acres / ha)[1]

	Alternative 1 Route 15	***Alternative 2 NAVMAG (East/West)***	***Alternative 3 NAVMAG (North/South)***	***Alternative 4 NAVMAG (L-Shaped)***	***Alternative 5 NWF***
LFTRC Construction Footprint	383/ 155	275 / 111	370 / 150	356 / 144	256 / 104
LFTRC SDZ	3,379 / 1,367	3,433 / 1,389	3,179 / 1,286	4,418 / 1,788	3,701 / 1,498
Stand-alone HG Range at Andersen South	23 / 9	23 / 9	23 / 9	23 / 9	23 / 9
Access Road	0 / 0	107 / 43	0 / 0	121 / 49	59 / 24
Total Area	**3,785 / 1,532**	**3,838 / 1,553**	**3,572 / 1,446**	**4,918 / 1,990**	**4,039 / 1,635**

Notes: [1]The No-Action Alternative is not included in this or the following table because a decision regarding the LFTRC would continue to be deferred under the No-Action Alternative, as it was in the 2010 ROD.

Table ES-3. Summary Comparison of Non-Federal Land Acquisition Requirements for LFTRC Alternatives (acres / ha)

	Alternative 1 Route 15	***Alternative 2 NAVMAG (East/West)***	***Alternative 3 NAVMAG (North/South)***	***Alternative 4 NAVMAG (L-Shaped)***	***Alternative 5 NWF***
Minimum Land Acquisition (Parcels Subdivided)[1]	896 / 363	1,894 / 766	252 / 102	914 / 370	0
Maximum Land Acquisition (Parcels Not Subdivided)[2]	915 / 370	3,648 / 1,476	905 / 366	3,671 / 1,486	0

Notes: [1]Assumes that the minimum amount of land required could be acquired, which would require subdividing larger parcels.
[2]Assumes that subdivision of larger parcels encompassing the required land would not be achievable and larger parcels would need to be acquired.

ES-4.4.3 Information Technology/Communications Links Between Alternatives

IT/COMM would require inter-base connections between the new Marine Corps cantonment and family housing areas and other existing bases, the LFTRC, and training facilities at Andersen South (covered by the 2010 Final EIS and ROD). Off-site conduits would be installed along existing roads between the facilities. The size of the potential construction footprint for the IT/COMM lines associated with each pairing of a cantonment/family housing alternative with an LFTRC alternative is shown in Table ES-4.

Table ES-4. Construction Footprint for Routing of IT/COMM Links between Alternatives (acres / ha)

Cantonment/Family Housing Alternatives	*LFTRC Alternatives*				
	Alternative 1 Route 15	*Alternative 2 NAVMAG (East/West)*	*Alternative 3 NAVMAG (North/South)*	*Alternative 4 NAVMAG (L-Shaped)*	*Alternative 5 NWF*
Alternative A: Finegayan	416 / 168	563 / 228	537 / 217	566 / 229	431 / 174
Alternative B: Finegayan/South Finegayan	416 / 168	563 / 228	537 / 217	566 / 229	431 / 174
Alternative C: AAFB	352 / 142	522 / 211	496 / 201	524 / 212	390 / 158
Alternative D: Barrigada	431 / 174	561 / 227	534 / 216	563 / 228	515 / 208
Alternative E: Finegayan/AAFB	416 / 168	563 / 228	537 / 217	566 / 229	431 / 174

ES-5 BEST MANAGEMENT PRACTICES

Regardless of the alternative considered, the proposed action would include the implementation of Best Management Practices (BMPs) to proactively reduce, minimize, or avoid impacts. BMPs are existing policies, practices, and measures that the DON would adopt to reduce the environmental impacts of designated activities, functions, or processes. Although BMPs mitigate potential impacts by avoiding, minimizing, or reducing/eliminating impacts, BMPs are distinguished from potential mitigation measures because BMPs are (1) existing requirements for the proposed action, (2) ongoing, regularly occurring practices, or (3) not unique to this proposed action. In other words, the BMPs identified in this SEIS are inherently part of the proposed action and are not potential mitigation measures proposed as a function of the NEPA environmental review process for the proposed action. The application of BMPs is, however, factored into the environmental impact analysis for each resource category and may influence the conclusions resulting from such analyses. Specific BMPs that would be included in the proposed action are described in Section 2.8.

ES-6 PREFERRED ALTERNATIVE

According to the CEQ, the agency's preferred alternative is the alternative that the agency believes best fulfills its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors (40 CFR 1502.14(e)). The DON considered military requirements, known infrastructure and environmental impacts and constraints, and input from the public, resource agencies, and the Government of Guam (GovGuam) to identify a preferred alternative. The DON’s preferred alternative is to construct and operate a cantonment at Finegayan and a family housing area at AAFB (Alternative E), plus an LFTRC at NWF (Alternative 5). This preferred alternative is different than what was identified in the Draft SEIS. Similar to the Draft SEIS preferred alternative (Alternative A [cantonment and family housing at Finegayan]), this new preferred alternative still meets Marine Corps operational requirements, maximizes the use of federal land on Guam, and optimizes operational efficiencies due to the relative proximity of the cantonment and LFTRC to one another. Additionally, compared to the preferred alternative in the Draft SEIS, this new preferred alternative would reduce the amount of vegetation that would have to be cleared, present additional opportunity for forest enhancement mitigation, maintain the natural buffer area between developed areas and nearby sensitive coastal resources, and leverage existing family housing support facilities already in place at AAFB. Figure ES-5 illustrates the components of the preferred alternative.

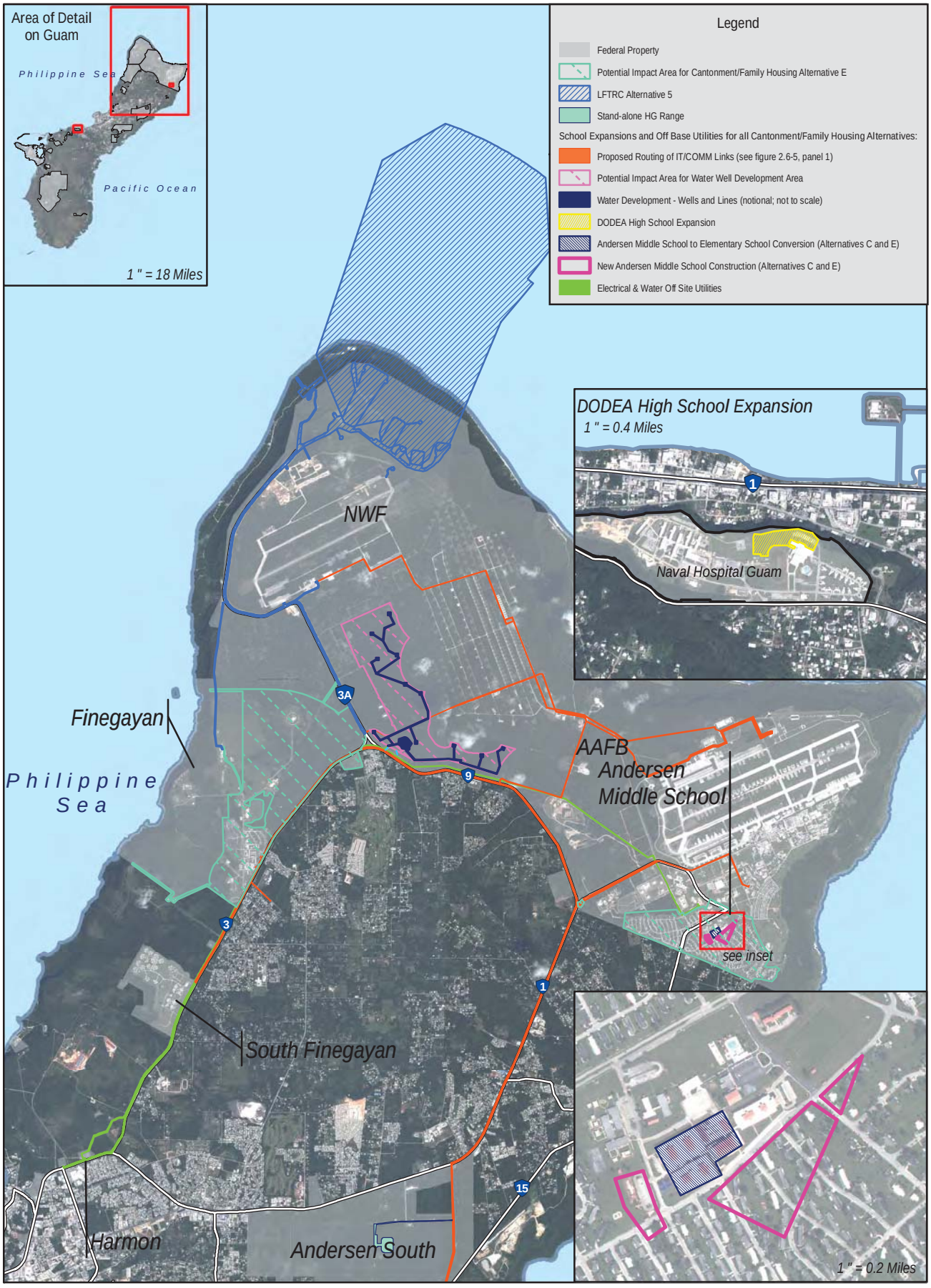


Figure ES-5
Preferred Alternative

The preferred alternative with Finegayan cantonment/AAFB family housing would comprise approximately 1,751 acres (709 ha) of federally-owned land. The cantonment area at Finegayan is bounded on the north by NWF and Route 3, and on the west by a cliffline (within DoD property), the Haputo Ecological Reserve Area (ERA), and the Philippine Sea. The site is also bounded to the east by limited residential development and to the south by the Dos Amantes planned area, also known as the former Harmon Village (non-federal property). Although DoD property descends to the coastline, the cantonment would be situated on the upper area of Finegayan and would not encroach on the cliffline leading to the ocean or the adjacent ERA.

The family housing area would be located at the current AAFB family housing area, approximately 4.2 miles (6.8 kilometers) east of the proposed cantonment area. The proposed housing density at AAFB is 5.5 units per acre. The family housing area would be accessed by the existing family housing gate (the Santa Rosa Gate) at the northern end of Route 15 or from the AAFB Main Gate off Route 9. Existing family housing would be demolished and a maximum of 912 family housing units would be constructed as replacements for existing AAFB housing in addition to the 535 family housing units required for Marine Corps families. The total of up to 1,447 family housing units would be integrated into one large housing pool where all eligible personnel and families would live.

On-site DoD utilities development under Alternative E would include buried electrical, communications, water, and wastewater lines generally along existing or proposed roadways; a new electrical substation at Finegayan; two communication area distribution nodes; one ground level water storage tank at Finegayan; wastewater pump stations at both Finegayan and the AAFB family housing site; and a recycling facility and solid waste transfer facility at Finegayan. In addition, tie-ins of electrical, water, and wastewater lines would be implemented (mostly along existing roadway corridors for Routes 3 and 9 and along portions of interior AAFB roadway corridors) to connect the new on-base infrastructure to existing utility networks.

The LFTRC preferred alternative at NWF would comprise approximately 4,016 acres (1,626 ha) (not including the HG Range at Andersen South). Although Alternative 5 would not require acquisition of lands, access to areas within the Ritidian Unit of the Guam National Wildlife Refuge (NWR) that fall within the boundaries of range SDZs would be restricted when ranges are in use. The Ritidian Unit of the Guam NWR is owned and managed by the USFWS. The DON would pursue an agreement with USFWS in accordance with the provisions of Section 2822 of the Fiscal Year (FY) 2015 National Defense Authorization Act (NDAA) which would allow for the continued management of the Ritidian Unit consistent with the purposes for which it was established and the operation of the range SDZs associated with the LFTRC preferred alternative at NWF. The DON anticipates that access restrictions will be addressed in this agreement. Construction of Alternative 5 would cause direct disturbance to approximately 315 acres (128 ha). This would include approximately 256 acres (104 ha) for the construction of the individual ranges, range support building, range towers, internal range access roads, and a perimeter fence, as well as the relocation of USFWS facilities within the Ritidian Unit of the Guam NWR that would be encumbered by the range SDZs. As proposed and analyzed in this SEIS, approximately 59 additional acres (24 ha) would be disturbed by construction to improve existing roadways from the intersection of Routes 3, 3A, and 9 to the Ritidian Unit of the Guam NWR. Any decisions regarding the relocation of the USFWS facilities and/or construction to improve beach access at the Ritidian Unit of the Guam NWR are dependent upon the outcome of consultations under section 7 of the Endangered Species Act (ESA) and negotiation of the agreement authorized by Section 2822 of the FY 2015 NDAA. The remaining project area for Alternative 5 would include lands and submerged lands under the exclusive custody and control of the DON and the USFWS within the SDZ that would not be affected by construction. Power to the site would extend from an existing overhead line at NWF. Potable

water service to two range buildings would require installation of a water main to connect to the existing distribution system off site. Wastewater collection requirements for two range buildings and the relocated USFWS facility would include a combination of gravity sewer line, septic tank, and a self-contained vegetated effluent disposal basin.

ES-7 OVERVIEW OF ENVIRONMENTAL IMPACTS

ES-7.1 SUMMARY OF IMPACT DETERMINATIONS FOR ALL ALTERNATIVES

The SEIS analyzes the affected environment and potential environmental consequences for 18 distinct resource areas. These details are presented in the following chapters of the SEIS:

- ***Chapter 3*** introduces each of the 18 resource areas, including a discussion of key characteristics, relevant issues of concern given the nature of the proposed action, the regulatory framework established on behalf of each resource area, and the approach to analysis and impact assessment criteria that were applied in the analysis of potential environmental consequences of the action.
- ***Chapter 4*** describes the impact analyses associated with each of the five cantonment/family housing alternatives plus the No-Action Alternative, and includes for each alternative a discussion of the affected environment and the potential impacts for each of the 18 resources.
- ***Chapter 5*** describes the affected environment and impact analyses associated with each of the five LFTRC alternatives, including an analysis of all 18 resources for each of the alternatives.
- ***Chapter 6*** evaluates the "additive" impacts (i.e., those in addition to the impacts described in Chapters 4 and 5) that would result when a particular cantonment/family housing alternative is paired with a particular LFTRC alternative (e.g., the traffic generated between the cantonment and the LFTRC, or the effects of installing IT/COMM infrastructure between a specific cantonment/family housing area, an LFTRC, and other DoD facilities on Guam).
- ***Chapter 7*** evaluates the cumulative effects of implementing the 2012 Roadmap Adjustments in conjunction with those projects that remained final under the 2010 ROD and other past, present, and reasonably foreseeable future projects on Guam.

Table ES-5 consolidates and summarizes the findings of the impact analyses contained in Chapter 4 (cantonment/family housing alternatives) and Chapter 5 (LFTRC alternatives) for all action alternatives and for the No-Action Alternative. The findings for the preferred alternative (i.e., Alternative E for cantonment/family housing and Alternative 5 for LFTRC) are shaded in blue in the table. The impact determinations for all alternatives are abbreviated as follows:

- ***SI – Significant Impact.*** These impacts would be significant and either no mitigation measures have been identified that could reduce the impact to a less than significant level or the impact would remain significant even with the application of potential mitigation measures. Impacts that have been identified as SI are shown in **bold red** print in Table ES-5. The significant impacts identified for the preferred alternative (and any associated potential mitigation measures) are summarized later in this section.
- ***SI-M – Significant Impact-Mitigable.*** These impacts would be significant but may be reduced to a less than significant level with the application of potential mitigation measures. Such impacts are shown in **bold red** print in Table ES-5 and these impacts for the preferred alternative (along with the potential mitigation measures) are summarized later in this section.
- ***LSI – Less than Significant Impact.*** These impacts were determined to be less than significant for various reasons (e.g., because the impact did not exceed a regulatory threshold or because the

proactive implementation of BMPs as part of the proposed action would reduce the degree of impact). BMPs are discussed in Section 2.8 of the SEIS.

- ***NI – No Impact.***
- ***BI – Beneficial Impact.***

For most resource areas, impacts were assessed separately for both the construction phase of the proposed action and for ongoing (post-construction) operations. In some cases, resource impacts were assessed separately for component resources (e.g., in the case of water resources, impacts were assessed independently for surface water, groundwater, nearshore waters, and wetlands). Table ES-5 is organized to illustrate these distinctions in the reporting of impact results. In a few rare cases, impacts associated with a specific component resource are designated as not applicable (NA) (e.g., land acquisition impacts only apply to certain LFTRC alternatives and not to Alternative 5 or any of the cantonment/family housing alternatives). In the case of certain component resources of socioeconomics the analysis was island-wide and not location-dependent, so the impacts for LFTRC alternatives are designated in Table ES-5 as "included" (abbreviated as "Incl.") in the findings for the cantonment/family housing alternatives.

As shown in Table ES-5, the cantonment/family housing component of the proposed action (all five action alternatives) would yield no significant impacts to the following eight resources: geological and soil resources, air quality, noise, airspace, visual resources, ground transportation, marine transportation, and hazardous materials and waste. Three additional resources would be significantly impacted by only one of the five action alternatives: land use (Alternative B – Finegayan/South Finegayan), recreation (Alternative D – Barrigada), and public health and safety (Alternative C – AAFB).

For the LFTRC component of the action (all five alternatives), no significant impacts were identified for eight of the resource areas: air quality, marine biological resources, ground transportation, marine transportation, utilities, hazardous materials and waste, public health and safety, and environmental justice. For one additional resource (noise), significant impacts would result from only one alternative (Alternative 1 – Route 15).

The summary results in Table ES-5 also indicate that the preferred Alternative 5 is the only LFTRC alternative that would not result in significant operational impacts to civilian airspace, and is one of only two alternatives that would result in no significant impacts to water resources (wetlands) and visual resources (operations impacts).

Following Table ES-5, the SI and SI-M impacts attributed to the preferred alternative are summarized in more detail, along with associated potential mitigation measures. Relevant additive impacts from Chapter 6 and cumulative effects from Chapter 7 are also summarized for the preferred alternative. For further explanation of the findings for other alternatives, refer to the relevant sections of Chapters 4 and 5, or to the more extensive impact summary tables presented at the end of each of those chapters.

Table ES-5. Summary of Impact Determinations for Cantonment/Family Housing Alternatives and LFTRC Alternatives

	Resources	Cantonment/Family Housing Alternatives						LFTRC Alternatives				
		Alternative A – Finegayan	Alternative B – Finegayan/South Finegayan	Alternative C – AAFB	Alternative D – Barrigada	Alternative E – Finegayan/AAFB (Preferred Alternative)[1]	No-Action Alternative	Alternative 1 – Route 15	Alternative 2 – NAVMAG East/West	Alternative 3 – NAVMAG North/South	Alternative 4 – NAVMAG L-Shaped	Alternative 5 – NWF (Preferred Alternative)[1]
Geological & Soil Resources	**Construction**											
	Topography	LSI	LSI	LSI	LSI	LSI	LSI	SI[2]	LSI	SI	SI	SI
	Soils	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Sinkholes	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Geological Hazards	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Operation											
	Topography	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	Soils	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Sinkholes	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Geological Hazards	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Water Resources	**Construction**											
	Surface Water	NI	NI	NI	LSI	NI	NI	NI	LSI	LSI	LSI	NI
	Groundwater	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	LSI	LSI	LSI	LSI
	Nearshore Waters	SI	SI	SI	SI	SI	SI	NI	NI	NI	NI	NI
	Wetlands	NI	NI	NI	SI-M	NI	NI	NI	SI-M	SI-M	SI-M	NI
	Operation											
	Surface Water	NI	NI	NI	LSI	NI	SI-M	NI	LSI	LSI	LSI	NI
	Ground Water	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	LSI	LSI	LSI	LSI
	Nearshore Waters	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	NI	NI	NI	NI	NI
	Wetlands	NI	NI	NI	LSI	NI	SI-M	NI	LSI	LSI	LSI	NI
Air Quality	**Construction**	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Operation	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Noise	**Construction**	LSI	LSI	LSI	LSI	LSI	SI-M	LSI	NI	NI	NI	NI
	Operation	LSI	LSI	LSI	LSI	LSI	SI-M	SI-M	NI	NI	NI	NI
Airspace	**Construction**	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	Operation	NI	NI	NI	NI	NI	NI	SI-M	SI-M	SI-M	SI-M	LSI

Table ES-5. Summary of Impact Determinations for Cantonment/Family Housing Alternatives and LFTRC Alternatives

	Resources	Cantonment/Family Housing Alternatives						LFTRC Alternatives				
		Alternative A – Finegayan	Alternative B – Finegayan/South Finegayan	Alternative C – AAFB	Alternative D – Barrigada	Alternative E – Finegayan/AAFB (Preferred Alternative)[1]	No-Action Alternative	Alternative 1 – Route 15	Alternative 2 – NAVMAG East/West	Alternative 3 – NAVMAG North/South	Alternative 4 – NAVMAG L-Shaped	Alternative 5 – NWF (Preferred Alternative)[1]
Land and Submerged Land Use	**Construction**	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	Operation											
	Loss of Valued Use	NI	NI	NI	NI	NI	NI	SI	SI	NI	SI	NI
	Public Access	NI	SI-M	NI	NI	NI	SI	SI	SI-M	NI	SI-M	SI
	Compatible Use	LSI	LSI	LSI	LSI	LSI	LSI	SI	LSI	LSI	LSI	NI
Recreation	**Construction**	LSI	LSI	LSI	LSI	LSI	LSI	SI	LSI	LSI	LSI	LSI
	Operation	LSI	LSI	LSI	SI	LSI	SI-M	SI	LSI	LSI	LSI	SI
Terrestrial Biological Resources	**Construction**											
	Vegetation	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	SI-M	SI-M	SI-M
	Terrestrial Conservation Areas	SI-M	SI-M	SI-M	LSI	SI-M	SI-M	NI	NI	SI-M	SI-M	SI-M
	Native Wildlife	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Special-Status Species – ESA Listed/ Proposed	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	SI-M	SI-M	SI-M
	Special-Status Species – Guam Listed/ SOGCN	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	SI-M	SI-M	SI-M
	Operation											
	Vegetation	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Terrestrial Conservation Areas	SI-M	SI-M	NI	NI	SI-M	LSI	NI	LSI	LSI	LSI	LSI
	Native Wildlife	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Special-Status Species – ESA Listed/ Proposed	SI-M	SI-M	SI-M	NI	SI-M	SI-M	LSI	LSI	LSI	LSI	LSI
	Special-Status Species – Guam Listed/ SOGCN	NI	NI	NI	NI	NI	NI	LSI	LSI	LSI	LSI	LSI
Marine Biological Resources	**Construction**											
	Marine Flora and Invertebrates	SI	SI	SI	SI	SI	SI	LSI	NI	NI	NI	LSI
	Fish	SI	SI	SI	SI	SI	SI	LSI	NI	NI	NI	LSI
	Essential Fish Habitat	SI	SI	SI	SI	SI	SI	LSI	NI	NI	NI	LSI
	Special-Status Species – ESA Listed/Proposed	LSI	LSI	LSI	LSI	LSI	LSI	LSI	NI	NI	NI	LSI
	Marine Conservation Areas	NI	LSI	LSI	NI	LSI	LSI	NI	NI	NI	NI	LSI
	Operation											
	Marine Flora and Invertebrates	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	NI	NI	NI	LSI
	Fish	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	NI	NI	NI	LSI

Table ES-5. Summary of Impact Determinations for Cantonment/Family Housing Alternatives and LFTRC Alternatives

	Resources	Cantonment/Family Housing Alternatives						LFTRC Alternatives				
		Alternative A – Finegayan	Alternative B – Finegayan/South Finegayan	Alternative C – AAFB	Alternative D – Barrigada	Alternative E – Finegayan/AAFB (Preferred Alternative)[1]	No-Action Alternative	Alternative 1 – Route 15	Alternative 2 – NAVMAG East/West	Alternative 3 – NAVMAG North/South	Alternative 4 – NAVMAG L-Shaped	Alternative 5 – NWF (Preferred Alternative)[1]
	Essential Fish Habitat	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	NI	NI	NI	LSI
	Special-Status Species – ESA Listed/Proposed	LSI	LSI	LSI	LSI	LSI	LSI	LSI	NI	NI	NI	LSI
	Marine Conservation Areas	LSI	LSI	LSI	NI	LSI	LSI	NI	NI	NI	NI	LSI
CULTURAL RESOURCES	**Construction**	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M
CULTURAL RESOURCES	**Operation**	SI-M	SI-M	NI	NI	NI	SI-M	SI-M	SI-M	SI-M	SI-M	SI and SI-M
VISUAL RESOURCES	**Construction**	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
VISUAL RESOURCES	**Operation**	LSI	LSI	LSI	LSI	LSI	SI-M	SI-M	LSI	SI	SI	LSI
GROUND TRANS.	**Construction**	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
GROUND TRANS.	**Operation**	NI	NI	NI	NI	NI	LSI	NI	NI	NI	NI	NI
MARINE TRANS.	**Construction**	LSI	LSI	LSI	LSI	LSI	LSI	NI	NI	NI	NI	NI
MARINE TRANS.	**Operation**	LSI	LSI	LSI	LSI	LSI	LSI	LSI	NI	NI	NI	LSI
UTILITIES	**Construction**											
UTILITIES	*Electrical Power*	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
UTILITIES	*Potable Water*	LSI	LSI	LSI	LSI	LSI	SI	LSI	LSI	LSI	LSI	LSI
UTILITIES	*Wastewater*	SI	SI	SI	SI	SI	SI	LSI	LSI	LSI	LSI	LSI
UTILITIES	*Solid Waste*	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
UTILITIES	*IT/COMM*	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
UTILITIES	**Operation**											
UTILITIES	*Electrical Power*	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
UTILITIES	*Potable Water*	SI-M	SI-M	SI-M	SI-M	SI-M	SI	LSI	LSI	LSI	LSI	LSI
UTILITIES	*Wastewater*	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	LSI	LSI	LSI	LSI
UTILITIES	*Solid Waste*	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
UTILITIES	*IT/COMM*	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI

Table ES-5. Summary of Impact Determinations for Cantonment/Family Housing Alternatives and LFTRC Alternatives

	Resources	Cantonment/Family Housing Alternatives						LFTRC Alternatives				
		Alternative A – Finegayan	Alternative B – Finegayan/South Finegayan	Alternative C – AAFB	Alternative D – Barrigada	Alternative E – Finegayan/AAFB (Preferred Alternative)[1]	No-Action Alternative	Alternative 1 – Route 15	Alternative 2 – NAVMAG East/West	Alternative 3 – NAVMAG North/South	Alternative 4 – NAVMAG L-Shaped	Alternative 5 – NWF (Preferred Alternative)[1]
SOCIOECONOMICS & GENERAL SERVICES	**Construction and Operation**											
	Population Change	***SI***	***SI***	***SI***	***SI***	***SI***	***SI***	*Incl.*[3]	*Incl.*	*Incl.*	*Incl.*	*Incl.*
	Economic Activity											
	Construction	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	***SI***	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*
	Operation	*BI*	*BI*	*BI*	*BI*	*BI*	*BI*	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*
	Public Services											
	Construction	***SI-M***	***SI-M***	***SI-M***	***SI-M***	***SI-M***	***SI***	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*
	Operation	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	***SI***	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*
	Sociocultural Issues	***SI-M***	***SI-M***	***SI-M***	***SI-M***	***SI-M***	***SI***	*Incl.*	*Incl.*	*Incl.*	*Incl.*	*Incl.*
	Sociocultural Impacts of Land Acquisition	*NA*[4]	*NA*	*NA*	*NA*	*NA*	*NA*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
	Economic Impacts of Land Acquisition	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*LSI*	*LSI*	*LSI*	*LSI*	*NI*
HAZARDOUS MATERIALS & WASTE	**Construction**											
	Hazardous Materials	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
	Hazardous Waste	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
	Contaminated Sites	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*	*NI*	*NI*	*LSI*
	Toxic Substances	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*
	Operation											
	Hazardous Materials	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
	Hazardous Waste	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*
	Contaminated Sites	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*NI*	*NI*	*NI*	*LSI*
	Toxic Substances	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*LSI*	*NI*	*LSI*	*LSI*	*LSI*

Table ES-5. Summary of Impact Determinations for Cantonment/Family Housing Alternatives and LFTRC Alternatives

	Resources	Cantonment/Family Housing Alternatives						LFTRC Alternatives				
		Alternative A – Finegayan	Alternative B – Finegayan/South Finegayan	Alternative C – AAFB	Alternative D – Barrigada	Alternative E – Finegayan/AAFB (Preferred Alternative)[1]	No-Action Alternative	Alternative 1 – Route 15	Alternative 2 – NAVMAG East/West	Alternative 3 – NAVMAG North/South	Alternative 4 – NAVMAG L-Shaped	Alternative 5 – NWF (Preferred Alternative)[1]
Public Health & Safety	**Construction**											
	Notifiable Diseases	LSI	LSI	LSI	LSI	LSI	LSI	Incl.	Incl.	Incl.	Incl.	Incl.
	Mental Illness	LSI	LSI	LSI	LSI	LSI	LSI	Incl.	Incl.	Incl.	Incl.	Incl.
	Operational Safety	NI	NI	NI	NI	NI	NI	LSI	LSI	LSI	LSI	LSI
	Environmental Health	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Hazardous Substances	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
	Unexploded Ordnance	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Traffic Incidents	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Operation											
	Notifiable Diseases	LSI	LSI	LSI	LSI	LSI	LSI	Incl.	Incl.	Incl.	Incl.	Incl.
	Mental Illness	LSI	LSI	LSI	LSI	LSI	LSI	Incl.	Incl.	Incl.	Incl.	Incl.
	Operational Safety	NI	NI	***SI***	NI	NI	NI	LSI	LSI	LSI	LSI	LSI
	Environmental Health	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Hazardous Substances	NI	NI	NI	NI	NI	NI	LSI	LSI	LSI	LSI	LSI
	Unexploded Ordnance	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Traffic Incidents	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Environmental Justice & Protection of Children	**Construction and Operation**											
	Noise	LSI	LSI	LSI	LSI	LSI	LSI	LSI	NI	NI	NI	NI
	Recreation	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
	Land Acquisition	NA	NA	NA	NA	NA	NA	LSI	LSI	LSI	LSI	NI
	Socioeconomics	***SI-M***	***SI-M***	***SI-M***	***SI-M***	***SI-M***	***SI***	Incl.	Incl.	Incl.	Incl.	Incl.
	Public Health & Safety	***SI-M***	***SI-M***	***SI-M***	***SI-M***	***SI-M***	***SI***	LSI	LSI	LSI	LSI	LSI

Legend: BI = beneficial impact; NI = no impact; LSI = less than significant impact; SI = significant impact; SI-M = significant impact-mitigable; Incl. = Included (see note 3 below); NA = Not Applicable (see note 4 below); Trans. = Transportation; & = and; SOGCN = Species of Greatest Conservation Need.

Notes: [1] Blue shading indicates the Preferred Alternative: Finegayan Cantonment/AAFB Family Housing (Alternative E) and NWF LFTRC (Alternative 5).

[2] Impacts that are considered ***SI*** or ***SI-M*** are shown in **Bold red print**.

[3] *Incl.* = Included. The applicable determination of impacts for this resource is not location-dependent and was based on an island-wide analysis. Both the proposed LFTRC and the proposed cantonment/family housing components were factored into a single analysis and so the findings for LFTRC alternatives are included in the results for the cantonment/family housing alternatives.

[4] *NA* = Not applicable because land acquisition is not proposed for any of the cantonment/family housing alternatives.

ES-7.2 SUMMARY OF SIGNIFICANT IMPACTS AND POTENTIAL MITIGATION MEASURES FOR THE PREFERRED ALTERNATIVE

As shown in Table ES-5, the preferred cantonment and family housing alternative (Alternative E – Finegayan/AAFB) would result in significant impacts to seven resource areas: water resources, terrestrial biological resources, marine biological resources, cultural resources, utilities, socioeconomics and general services, and environmental justice. The preferred LFTRC alternative (Alternative 5 – NWF) would result in significant impacts to five resource areas: geological and soil resources, land use/submerged land use, recreation, terrestrial biological resources, and cultural resources. These findings are not unique to the preferred alternative, as the analysis in the SEIS indicates that the resource areas noted above would be significantly impacted by all or most of the other alternatives as well. The following subsections provide brief overviews of the significant impacts and associated mitigation measures for each of the primary components of the preferred alternative. Final mitigation measures will be determined after the completion of consultations with appropriate agencies and will be included in the ROD.

ES-7.2.1 Significant Impacts of Preferred Cantonment/Family Housing Alternative E – Finegayan/AAFB

Water Resources

Construction Impacts

Groundwater (SI-M): The Guam Waterworks Authority's (GWA) interceptor sewer from AAFB to the Northern District WWTP is in a state of deterioration and the number of spills from this system exceeds spill rate norms for similar wastewater systems. Increased wastewater flows associated with the construction/DoD workforce and induced civilian growth during the construction phase of Alternative E would potentially increase the rate of sewage spills, resulting in significant but mitigable indirect impacts to groundwater quality.

Potential Mitigation

- Refurbishment of the GWA interceptor sewer system would mitigate significant impacts to groundwater resources during the construction phase of the proposed action. The FY 2014 NDAA directed the Secretary of Defense to convene the Economic Adjustment Committee (EAC) in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system and expansion/rehabilitation of the Northern Guam Lens Aquifer (NGLA) monitoring network for sustainment of the NGLA. To support the implementation plan, DoD assessed GWA water and wastewater systems that may be affected by the preferred alternative. The water and wastewater assessment recommended the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Also, Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the Office of Economic Adjustment (OEA), for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

Nearshore Waters (SI): Increased wastewater flows associated with induced civilian and construction/DoD workforce growth under Alternative E would result in a significant and unmitigable indirect impact to nearshore waters from increased wastewater discharge from the Northern District WWTP outfall. The Northern District WWTP is non-compliant with the current National Pollutant

Discharge Elimination System (NPDES) permit and increasing the wastewater discharge from a non-compliant treatment plant would be a significant indirect impact during the period of noncompliance. Until the WWTP upgrades are completed (not anticipated until early in the operational phase of the proposed action) there would be an indirect and unmitigable significant impact to nearshore waters during construction.

Operation Impacts

Groundwater (SI-M): Operation of the cantonment/family housing facilities under Alternative E would result in a significant but mitigable impact to groundwater in the form of a long-term increase in annual groundwater production (withdrawal) of 1.7 million gallons per day, which could result in a localized significant impact to the NGLA. In addition, the GWA interceptor sewer from AAFB to the Northern District WWTP is in a state of deterioration that requires refurbishment. Increased wastewater flow from the proposed relocation would accelerate this deterioration. Should this sewer experience a failure, the NGLA could be negatively impacted from failing sewer pipes, exposing the NGLA to raw sewage.

Potential Mitigation

- The DoD would, as appropriate, implement enhanced water conservation measures for the proposed action, improve existing DoD potable water systems to reduce system leaks, adjust pumping rates at DoD wells, and increase the use of existing wells and/or surface water from Fena Reservoir in order to reduce withdrawals from the NGLA.
- The DoD would continue to support the Guam Water Resources Development Group (GWRDG) and would support the U.S. Geological Survey's (USGS's) recommendation to rehabilitate and expand the hydrologic data collection network and monitoring necessary to ensure sustainable management of NGLA.
- As required in the FY 2014 NDAA, the EAC implementation plan will address public infrastructure requirements necessary to support the preferred alternative, as well as address groundwater-related issues including technical and financial assistance for an updated and expanded NGLA monitoring well network and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the NGLA monitoring well network. To support this implementation plan, DoD assessed GWA's water and wastewater systems that may be affected by the preferred alternative. The water and wastewater assessment recommended an updated and expanded NGLA monitoring well network and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

Nearshore Waters (SI-M): Operation of the cantonment and family housing facilities under Alternative E would result in a significant but mitigable impact to nearshore waters from increased wastewater discharge from the Northern District WWTP outfall. The Northern District WWTP is non-compliant with the treatment standards required by the current NPDES permit and increasing the wastewater discharge from a non-compliant treatment plant would be a significant indirect impact during the period of non-compliance. However, upgrades to bring the Northern District WWTP into compliance with the permit

are expected to be completed early in the operational phase of the proposed action and such upgrades would mitigate the impact to a less than significant level.

Potential Mitigation

- Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate significant impacts to the wastewater system on Guam once the upgrades are completed. In addition, refurbishing the main GWA sewer lines from AAFB to the Northern District WWTP along Routes 3 and 9 would mitigate potential failure of the concrete reinforced sewer lines that are in a state of deterioration. The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. The water and wastewater assessment that DoD prepared to support the Implementation Plan recommended upgrades to the Northern District WWTP and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

Terrestrial Biological Resources

Construction Impacts

Vegetation (SI-M): Construction of the cantonment facilities under Alternative E would result in a significant but mitigable impact to vegetation due to the conversion of 780 acres (316 ha) of limestone forest to developed area. Construction of the family housing facilities under Alternative E would have less than significant impact to this resource.

Potential Mitigation

- Forest enhancement on a minimum of 780 acres (316 ha) of limestone forest.

Terrestrial Conservation Areas (SI-M): Construction of the cantonment facilities under Alternative E would result in a significant but mitigable impact to terrestrial conservation areas due to the conversion of 1,065 acres (431 ha) of Overlay Refuge lands to developed area. Construction of the family housing facilities under Alternative E would have less than significant impact to this resource.

Potential Mitigation

- Submit a proposal to designate NAVMAG ERA.
- Submit a proposal for the expansion of Orote Peninsula ERA.

Special-Status Species – Federal ESA-Listed/Proposed Species (SI-M): Construction of the cantonment facilities under Alternative E would result in significant but mitigable impacts to special-status species (Federal ESA-listed/proposed species) as a result of impacts to 719 acres (291 ha) of Mariana fruit bat recovery habitat, 719 acres (291 ha) of Mariana crow recovery habitat, 507 acres (205 ha) of Guam rail recovery habitat, 719 acres (291 ha) of Guam Micronesian kingfisher recovery habitat, and 648 acres (262 ha) of *Serianthes* recovery habitat. Construction of the family housing facilities under Alternative E would have less than significant impact to this resource.

As part of the ESA section 7 consultation process, the DON and the USFWS entered into a Memorandum of Agreement (MOA) which would, if the preferred alternative is chosen, facilitate Guam Micronesian kingfisher conservation goals. In the MOA, the DON agreed to designate approximately 5,234 acres (2,118 ha) under the custody and control of the DoD in northern Guam to a status that will provide durable habitat protection needed to support native habitat restoration and land management for the survival and recovery of the kingfisher. Consistent with the Joint Region Marianas (JRM) Integrated Natural Resources Management Plan (INRMP) developed in accordance with Section 101 of the Sikes Act, the DON agreed to actively restore native habitat and manage, in collaboration with the USFWS, the 5,234 acres (2,118 ha) consistent with the DoD's obligations under ESA section 7(a) and the Sikes Act to benefit the survival and recovery of the kingfisher. The DON would work cooperatively with the USFWS to identify, develop and implement specific management activities and projects on these 5,234 acres (2,118 ha) to support the reintroduction and recovery of the kingfisher. These 5,234 acres (2,118 ha) have been identified by the USFWS as habitat for the kingfisher and needed to offset impacts of the proposed action. The DON and USFWS recognize that the designation of the 5,234 acres (2,118 ha) may also provide a conservation benefit to other ESA-listed species with similar habitat requirements (e.g. Mariana crow, Mariana fruit bat).

Potential Mitigation

- Brown treesnake research and suppression.
- Implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit these species.

Special-Status Species – Guam-Listed and Species of Greatest Conservation Need (SOGCN) (SI-M): Impacts and mitigation associated with Guam-listed species that are also federally listed would be the same as described above. Impacts to other Guam-listed species from construction of the cantonment facilities under Alternative E would include significant but mitigable impacts to special-status species (Guam-listed and SOGCN) due to loss of 765 acres (310 ha) of occupied moth skink and Pacific slender-toed gecko habitat. Construction of the family housing facilities under Alternative E would result in less than significant impacts to this resource.

Potential Mitigation

- Implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit these species.

Operation Impacts

Terrestrial Conservation Areas (SI-M): Operation of the cantonment/family housing facilities under Alternative E would result in a significant but mitigable impact to terrestrial conservation areas due to potential increased usage of the Haputo ERA by military and civilian personnel.

Potential Mitigation

- Fencing.
- Info/educational signage.
- Educational materials regarding sensitive biological resources.
- Monitoring of visitor use.

Special-Status Species – Federal ESA-Listed/Proposed Species (SI-M): Operation of the cantonment/family housing facilities under Alternative E would result in significant but mitigable impacts to special-status species (Federal ESA-listed/proposed species) as a result of impacts to Mariana fruit bat habitat due to lights, noise, and human activity.

Potential Mitigation

- Haputo ERA – fencing, info/educational signage, educational materials regarding sensitive biological resources, and monitoring of visitor use.
- Continued implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit the Mariana fruit bat.

Marine Biological Resources

Construction Impacts (SI)

Induced civilian and construction/DoD workforce growth under Alternative E would result in a significant unmitigable indirect impact to marine flora and invertebrates, fish, and Essential Fish Habitat from increased wastewater discharge from the Northern District WWTP outfall. The Northern District WWTP is non-compliant with the standards required by its current NPDES permit and increasing the wastewater discharge from a non-compliant treatment plant would be a significant indirect impact. Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate the significant indirect impacts once the upgrades are completed. Until the WWTP upgrades are completed (anticipated to be early in the operational phase of the proposed action) there would be an indirect and unmitigable significant impact to nearshore waters during construction.

Operation Impacts (SI-M)

Operation of the cantonment and family housing facilities under Alternative E would result in a significant but mitigable impact to marine flora and invertebrates, fish, and Essential Fish Habitat from increased wastewater discharge from the Northern District WWTP outfall. The Northern District WWTP is non-compliant with the treatment standards required by the current NPDES permit and increasing the wastewater discharge from a non-compliant treatment plant would result in significant indirect impacts during the period of non-compliance. However, upgrades to bring the Northern District WWTP into compliance with the permit are expected to be completed early in the operational phase of the proposed action.

Potential Mitigation

- Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate significant impacts to marine biological resources. The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. The water and wastewater assessment that DoD prepared to support the Implementation Plan recommended upgrades to the Northern District WWTP and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of

Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

Cultural Resources

Construction Impacts (SI-M)

Construction of the cantonment/housing family housing facilities under Alternative E would result in significant but mitigable potential direct adverse effects to 17 historic properties (16 National Register of Historic Places [NRHP]-eligible archaeological sites and 1 NRHP-eligible structure) and undetermined effects to 14 unevaluated buildings.

Potential Mitigation

- Proposed mitigation through 2011 Programmatic Agreement (PA) processes, including data recovery and contractor measures, and coordination with State Historic Preservation Office (SHPO), concurring parties, and knowledgeable traditional practitioners.

Operation Impacts (NI)

Operations associated with Alternative E would not directly affect any historic properties or impact other resources of cultural importance.

Utilities

Construction Impacts

Wastewater (SI): Construction of the cantonment/family housing facilities under Alternative E would result in significant direct impacts during the period of non-compliance with the 2013 NPDES permit at the Northern District WWTP.

Potential Mitigation

- Potential mitigation measures during construction would include constructing sewers during low flow periods, by-pass pumping, and having pump trucks on stand-by.

Operation Impacts

Potable Water (NGLA impact) (SI-M): Operation of the cantonment/family housing facilities under Alternative E would result in significant but mitigable short-term, localized significant impacts to the affected basin within the NGLA but less than significant impacts to the overall NGLA. Increased withdrawal from the NGLA may result in higher levels of chloride concentrations. The chloride concentration spikes could be a localized phenomenon, based on USGS modeling of the NGLA.

Potential Mitigation

- The DoD would, as appropriate, implement enhanced water conservation measures for the proposed action, improve existing DoD water systems to reduce system leaks, adjust pumping rates at DoD wells, and increase the use of surface water in northern Guam from Fena Reservoir in order to reduce withdrawals from the NGLA.
- The DoD would continue to support the GWRDG and would support USGS's recommendation to rehabilitate and expand the hydrologic data collection network and monitoring necessary to ensure sustainable management of NGLA.
- The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the

preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including rehabilitation and expansion of the NGLA monitoring well network. The water and wastewater assessment that DoD prepared to support the Implementation Plan recommended an updated and expanded NGLA monitoring well network. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

Wastewater (SI-M): Operation of the cantonment/family housing facilities under Alternative E would result in significant direct impacts during the period of non-compliance with the 2013 NPDES permit at the Northern District WWTP. However, upgrades to bring the Northern District WWTP into compliance with the permit are expected to be completed early in the operational phase of the proposed action. This operation would also generate additional wastewater flow from both AAFB family housing facilities and Finegayan cantonment that would utilize the existing GWA interceptor sewer system from AAFB to the Northern District WWTP. This interceptor sewer system is in a state of deterioration that requires rehabilitation. The additional wastewater flow from the proposed action would accelerate this deterioration and could result in sewer system failure.

Potential Mitigation

- Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate significant impacts to the wastewater system on Guam. In addition, refurbishing the main GWA sewer lines from AAFB to the Northern District WWTP along Routes 3 and 9 would mitigate potential failure of the concrete reinforced sewer lines that are in a state of deterioration. The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. The water and wastewater assessment that DoD prepared to support the Implementation Plan recommended upgrades to the Northern District WWTP and refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

Socioeconomics and General Services

Construction and Operation Impacts

Population Change (SI): The population change associated with the proposed Marine Corps relocation would be considered significant during both the construction and operations phases (given that population change would exceed 2%). Between the years 2021 and 2023 the population with the proposed action is 5.6% higher than it otherwise would have been without the proposed action. At a steady-state the difference would be 4.1%. However, the significant change would not be considered entirely negative. Impacts related to population change would be mixed, with some adverse and some beneficial outcomes.

Potential Mitigation

- No mitigation is proposed as the population increase would not likely result in a sustained increase in demand on Guam's public services and permitting agencies, and the estimated increases in GovGuam tax revenues would likely compensate for any increased demand on public services that would occur.

Public Services (SI-M): During construction, all categories of public services agencies combined would require an estimated 185 additional employees, an increase of 3.6% over baseline staffing levels. This maximum increase in staffing levels would be temporary, lasting from approximately 2021 through 2023. During this short period, staffing requirements for many public service agencies would increase by more than 2% and, given existing deficiencies at many agencies, significant impacts were identified. However, over the longer term, GovGuam agencies would require an additional 66 staff (an increase of 1.3% over baseline levels), which would be less than significant. From a broad perspective, looking at the entire group of GovGuam public services agencies overall, impacts would be considered significant in the short-term and less than significant in the long-term steady-state. While the total number of additional staff required during the relatively short construction phase may appear manageable (representing only a 3.6% increase over baseline staffing), other factors including existing shortfalls in staffing and deficiencies in facilities and equipment were considered when determining significance. As discussed, no mitigation is proposed as the population increase would not likely result in a sustained increase in demand on Guam's public services and permitting agencies, and the estimated increases in GovGuam tax revenues would likely compensate for any increased demand on public services that would occur. However, while additional tax revenues to GovGuam associated with the proposed action would compensate for additional costs that would be incurred, and ample time should be available to plan for short-term staff increases, GovGuam agencies may still face challenges. For the short-term significant impacts on public services, the following potential mitigation measures are identified.

Potential Mitigation

- The DoD would continue to support the efforts of the Civilian Military Coordination Council (CMCC) to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded. Such support may include providing project-related employment and population forecasts, participating in the identification of shortfalls in Guam public services, and assisting in the identification of federal programs and funding sources that may help GovGuam to address shortfalls.
- The DoD would continue to support existing programs that contribute and/or donate excess equipment to local agencies.

Sociocultural Issues (SI-M): There is a potential for sociocultural impact to occur, but the magnitude of the impacts are difficult to predict and could vary substantially based on policy and program choices yet to be made as how to address them. For these reasons, and for the purposes of this SEIS, impacts to sociocultural issues are conservatively classified as significant.

Potential Mitigation

- In accordance with the 2011 PA, the DoD will conduct orientation briefs for all incoming DoD personnel, their families, and contractors regarding cultural sensitivity in the area. All DoD personnel and contractors working on Guam will receive annual briefings. The DoD will develop the briefing in consultation with the appropriate SHPO and will provide SHPO with a copy of the final briefing materials.
- The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth to address sociocultural issues. See Section 2.9 for further discussion on the CMCC.
- In accordance with the 2011 PA, the $12,000,000 appropriated under the FY 2012 Consolidated Appropriations Act (Public Law 112-74) for a Guam Cultural Repository facility remains in place. The appropriation provides funding for a repository for curation of archaeological collections on Guam and to serve as a source of information on Guam history and culture. As directed by the FY 2014 NDAA, the DoD would convene the EAC to consider necessary technical and financial assistance and develop an implementation plan coordinated with EAC federal agencies. This plan must be submitted to the congressional defense committees as part of a reporting requirement that is due no later than the date of issuance of the ROD.

Environmental Justice and Protection of Children

Construction and Operation Impacts

Socioeconomics and General Services (SI-M): Temporary population growth may stress some sectors of the Guam economy (e.g., housing, costs of goods and services). In the short-term (during construction), direct and indirect impacts to health services would be significant; during the steady-state period (operational phase), impacts to public health and human service agencies would be less than significant.

This would be felt more severely by low-income people, who often do not have resources to buffer hard economic times. However, there would also be some economic benefits due to increased employment opportunities. There would be adverse and disproportionate socioeconomic impacts in terms of environmental justice on low-income populations; however, some of the socioeconomic impacts would be beneficial (e.g., economic impacts).

Potential Mitigation

- The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded. Such support would include providing project-related employment and population forecasts, participating in the identification of shortfalls in Guam public services, and assisting in the identification of federal programs and funding sources that would help GovGuam to address shortfalls.
- As directed by the FY 2014 NDAA, the DoD would convene the EAC to consider necessary technical and financial assistance and develop an implementation plan coordinated with EAC federal agencies. This plan must be submitted to the congressional defense committees as part of a reporting requirement that is due no later than the date of issuance of the ROD.

Public Health and Safety (SI-M): Since the number of public health and safety professionals required to maintain current levels of service at public health and safety agencies would increase by more than 2%, and due to existing deficiencies in facilities and equipment at these agencies, there would be short-term, direct and indirect significant impacts to public health agencies and significant direct and indirect impacts on public safety agencies, both short-term (during construction) and during the steady-state period (during operation). Given that public health agencies that serve low-income and uninsured populations already have insufficient staffing levels, population increase would further strain these resources, causing a significant environmental justice impact.

Potential Mitigation

- The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded. Such support may include providing project-related employment and population forecasts, participating in the identification of shortfalls in Guam public services, and assisting in the identification of federal programs and funding sources that may help GovGuam to address shortfalls.
- The FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $13,000,000 for the construction of a regional public health laboratory on Guam; these funds remain in place. The public health laboratory would alleviate some existing deficiencies in Guam's public health infrastructure, and bolster Guam's capability to meet public health demands brought about by project-related population, by providing a facility that would help identify, treat, and control diseases of public health concern.
- As directed by the FY 2014 NDAA, the DoD would convene the EAC to consider necessary technical and financial assistance and develop an implementation plan coordinated with EAC federal agencies. This plan must be submitted to the congressional defense committees as part of a reporting requirement that is due no later than the date of issuance of the ROD.

ES-7.2.2 Significant Impacts of the Preferred LFTRC Alternative 5 – NWF

Geological and Soil Resources

Construction Impacts

Topography (SI): Construction of the LFTRC under Alternative 5 would result in a significant direct, long-term impact to topography in the form of major changes to surface elevation due to excavation and filling for construction of the MPMG Range.

Potential Mitigation

- Mitigation is not considered feasible for this impact because smaller cut/fill volumes would not provide the necessary level surfaces for the MPMG Range.

Operation Impacts

No significant operation impacts have been identified for this resource.

Land and Submerged Land Use

Construction Impacts

No significant construction impacts have been identified for this resource.

Operation Impacts

Public Access (SI): Although the land and submerged land use within the Ritidian Unit of the NWR would remain as Conservation land use, there would be access restrictions to the land and submerged lands within the SDZs while the ranges are in use. Such restrictions would be limited to the minimum SDZ area and period of use required for the LFTRC. Access to non-NWR submerged lands under the custody and control of the DON would be similarly restricted. The DON would pursue an agreement with the USFWS in accordance with the provisions of Section 2822 of the FY 2015 NDAA to ensure that access restrictions to the Ritidian Unit are consistent with the purposes for which the Unit was established. New beach access is proposed near the relocation of the USFWS facilities to partially offset the impact of proposed restrictions on beach access within the SDZ.

Potential Mitigation

- No mitigation measures have been identified.

Recreational Resources

Construction Impacts

No significant construction impacts have been identified for this resource.

Operation Impacts (SI)

Operation of the LFTRC under Alternative 5 would result in significant impacts due to loss of access to existing hiking trails and caves within the Ritidian Unit of the Guam NWR. These trails are currently open for access during normal refuge hours. Access to the areas within the MPMG Range SDZ would be restricted during MPMG Range operational periods. Recreational resources within the MPMG Range SDZ include a portion of existing hiking trails and caves containing ancient Chamorro paintings within the Ritidian Unit of the Guam NWR.

Potential Mitigation

- No mitigation measures have been identified.

Terrestrial Biological Resources

Construction Impacts

Vegetation (SI-M): Construction of the LFTRC under Alternative 5 would result in a significant but mitigable impact to vegetation due to the conversion of 219 acres (89 ha) of limestone forest to developed area.

Potential Mitigation

- Forest enhancement on a minimum of 219 acres (89 ha) of limestone forest.

Terrestrial Conservation Areas (SI-M): Construction of the LFTRC under Alternative 5 would result in a significant but mitigable impact to terrestrial conservation areas due to the conversion of 298 acres (121 ha) of Overlay Refuge lands to developed area.

Potential Mitigation

- Submit a proposal to designate an ERA on NAVMAG.
- Submit a proposal for the expansion of Orote Peninsula ERA.

Special-Status Species – Federal ESA-Listed/Proposed Species and Critical Habitat (SI-M): Construction of the LFTRC under Alternative 5 would result in a significant but mitigable impact to special-status species as a result of impacts to 215 acres (87 ha) of Mariana fruit bat recovery habitat, 215 acres (87 ha) of Mariana crow recovery habitat, 215 acres (87 ha) of Guam Micronesian kingfisher recovery habitat.

Potential Mitigation

- Forest enhancement on a minimum of 219 acres (87 ha) of limestone forest.
- Brown treesnake research and suppression.

Special-Status Species – Guam-Listed and SOGCN (SI-M):

Impacts and mitigations associated with Guam-listed species that are also federally listed would be the same as described above for those species. No additional Guam-listed species are known to occur in the project area for Alternative 5.

Operation Impacts

No significant operation impacts have been identified for this resource.

Cultural Resources

Construction Impacts (SI-M)

Construction of the LFTRC under Alternative 5 would result in significant but mitigable impacts. Twenty historic properties would be directly, adversely affected and culturally important natural resources could be impacted from vegetation removal.

Potential Mitigation

- Proposed mitigation through the 2011 PA process includes the development of a Range Mitigation Plan, archaeological data recovery, development of public education and interpretation materials, and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners for treatment of culturally important natural resources.

Operation Impacts (SI and SI-M)

Operation of the LFTRC under Alternative 5 would result in significant impacts, which are not fully mitigable, due to restricted access to two NRHP-eligible archaeological sites. Significant but mitigable impacts would result from indirect adverse effects to three NRHP-eligible sites due to changes in use that degrades site integrity.

Potential Mitigation

- Partial mitigation of significant impacts resulting from changes in use and reduced access through the 2011 PA process, which includes the development of a Range Mitigation Plan, consultation to identify and evaluate appropriate noise-reducing measures, and amending the existing access plan.

ES-7.2.3 Significant Additive Impacts of the Preferred Alternative

For the purposes of this SEIS, additive impacts are those that would result specifically from the combination of a cantonment/family housing alternative with an LFTRC alternative. Consequently, these project impacts are not addressed in Chapter 4 (cantonment/family housing impacts) or Chapter 5 (LFTRC impacts). The additive impacts resulting from the combination of the preferred cantonment/family housing Alternative E and LFTRC Alternative 5 would yield no additional significant impacts to the following 16 resources: geological and soil resources, water resources, air quality, noise, airspace, land and submerged land use, recreational resources, terrestrial biological resources, marine biological resources, visual resources, marine transportation, utilities, socioeconomic and general services, hazardous materials and waste, public health and safety, and environmental justice and the protection of children.

The additive impacts of the preferred alternative would yield significant but mitigable impacts to two resources: cultural resources and ground transportation. The significant but mitigable additive impacts of the preferred alternative are summarized below.

Cultural Resources (SI-M)

There would be significant but mitigable impacts as a result of potential adverse effects to six known historic properties from construction of IT/COMM lines. There would be no adverse effects from operation of IT/COMM.

Potential Mitigation

- Measures outlined in the 2011 PA would reduce impacts to a level below significance.

Ground Transportation (SI-M)

There would be a slight increase in traffic on segments and intersections between the cantonment at Finegayan, the family housing at AAFB, and the LFTRC at NWF. There would be potentially significant impact on eight segments in at least one direction and ten intersections for weekday a.m. and/or p.m. peak hours.

Potential Mitigation

To reduce impacts to less than significant levels on roadway segments, the following eight roadway widening projects are recommended:

- Route 1, from Route 3 to Route 34.
- Route 1, from Route 34 to Route 16.
- Route 3, from Route 3A/9 to Finegayan Main Gate.
- Route 3, from Finegayan Main Gate to Finegayan Residential Gate.
- Route 3, from Finegayan Residential Gate to Route 28.
- Route 3, from Route 28 to South Finegayan Main Gate.
- Route 3, from South Finegayan Main Gate to Route 1.
- Route 28, from Chalan Balako to Route 3.

To reduce impacts to less than significant levels on intersections, improvement projects are recommended at the following intersections:

- Route 3 / 3A / 9.
- Route 3 / Royal Palm Drive.
- Route 1 / Route 3.

- Route 1 / Route 27.
- Route 1 / Route 26.
- Route 16 / Route 27.
- Route 16 / Route 10A.
- Route 1 / Route 14A.
- Route 1 / Route 10A.

ES-7.2.4 Significant Cumulative Impacts of the Preferred Alternative

The assessment of cumulative effects presented in Chapter 7 of this SEIS addresses the potential long-term impacts of recently completed, present, and reasonably foreseeable future projects in conjunction with the proposed action. The resources most likely to be adversely affected by projects are terrestrial biology and cultural. This is largely due to the fact that most projects would result in ground disturbance and potential for removal or disturbance of habitat and cultural resources. For these reasons, a brief summary of cumulative impacts to terrestrial biological resources and cultural resources is discussed below. The resource areas that benefit most from the projects listed are ground transportation, utilities, socioeconomic and general services, public health and safety, and environmental justice and the protection of children. This is because many of the GovGuam projects are capital improvement projects designed to support the health and safety of the community. A nearly equal number of projects having adverse and beneficial impacts were identified for geological and soil resources and water resources. Air quality, noise, airspace, land use, recreational resources, and marine transportation resource areas are impacted by fewer projects than other resource areas, either beneficially or adversely. Please refer to Chapter 7 of this SEIS for a detailed cumulative impact analysis.

Terrestrial Biological Resources

The following are the general types of projects or activities that may result in cumulative impacts to terrestrial biological resources:

- Loss or conversion of native habitat would reduce the potential recovery and survival of ESA-listed species creating an adverse impact.
- Reductions and management activities (i.e., fencing, removal) of invasive species and/or feral ungulates or their access to habitat would have a beneficial impact.
- Projects involving ground disturbance, such as construction of housing or new and widened roadways, would contribute to an adverse cumulative effect. Projects that are renovations or improvements to existing facilities within the existing facility footprint would have no impact on terrestrial biological resources, such as resurfacing a roadway.

Recently completed projects, present projects, and reasonably foreseeable projects all have the potential to contribute to adverse cumulative effects to terrestrial biological resources. The primary impact from these projects would be the potential loss of native habitat and the increased potential for the spread of invasive species. All five resource areas assessed (e.g., vegetation, terrestrial conservation areas, native wildlife, federal special-status species, Guam special-status species) would be significantly impacted by the direct and indirect impacts of the LFTRC and cantonment combinations, except there would be a less than significant impact on native vegetation for all combinations. The adverse impacts would occur during construction and operations phases. Most of the projects require ground disturbance, and the assumption is that terrestrial biological resources would be affected. The terrestrial biological resource health on Guam would continue to decline, and threatened and endangered species would continue to be vulnerable to natural and anthropogenic stressors.

Potential Mitigation

- GovGuam reviews public, private, and commercial development proposals for potential impacts to terrestrial biological resources. The USFWS monitors GovGuam, private, and commercial development proposals and periodically adjusts the acreage of available recovery habitat island-wide. This adjustment is used to determine the impact of federal development proposals that must comply with section 7 of the ESA and may result in mitigation for federal development proposals. The USFWS and GovGuam review DoD and other federal development proposals and mitigation is developed through the consultation process. There are local and federal initiatives and protocols to prevent the introduction of non-native species. There are local and federal conservation and restoration efforts. No additional mitigation is proposed for cumulative impacts to terrestrial biological resources.

Cultural Resources

The following are the general types of projects that may result in cumulative impacts to cultural resources:

- Projects that result in adverse effects to historic properties can lead to a cumulative loss of the archaeological and built-historical record that could contribute to an adverse cumulative impact.
- Projects that damage culturally important natural resources can lead to an adverse cumulative impact.
- Projects that lead to reduced access to cultural sites can lead to an adverse cumulative impact.

Recently completed projects, present projects, and reasonably foreseeable projects all have the potential to contribute to adverse cumulative effects to cultural resources. The primary impact from these projects would be direct and indirect adverse effects to historic properties, archaeological sites, and impacts to culturally important natural resources. Direct and indirect adverse effects would contribute to the decline in preservation of cultural resources. Other factors unrelated to the project, such as vandalism and weathering, would continue to adversely impact cultural resources. Disturbance or destruction of cultural resources would further diminish the regional historic record, thus decreasing the potential of its overall research contribution. The loss of culturally important natural resources would reduce opportunities for important cultural practices. Reduced access to cultural sites, whether for cultural practices, recreation, tourism, or academic study, would also diminish the cultural resources of Guam.

Potential Mitigation

Potential mitigation for cumulative impacts would include the following:

- Support Guam SHPO's update of the Guam Historic Preservation Plan.
- Beginning in 2017, update the Guam Synthesis with information from DoD studies in concert with the Guam Historic Preservation Plan.
- Nominate two or more historic properties on DoD land per year for listing in the NRHP.
- In accordance with the 2011 PA, support construction of a Guam Cultural Repository and seek congressional authorization to transfer DoD funding for the construction. The $12,000,000 appropriated under the FY 2012 Consolidated Appropriations Act (Public Law 112-74) for a Guam Cultural Repository facility remains in place. The appropriation provides funding for a repository for curation of archaeological collections on Guam and to serve as a source of information on Guam history and culture.
- Advocate to other federal agencies to provide funding for the Guam Museum Complex.

With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that significant cumulative impacts would be partially mitigated but not to a less than significant level.

ES-7.2.5 Issues to be Resolved

USFWS Replacement Facilities and Public Access to Ritidian Beach

If Alternative 5 (locating the LFTRC at NWF) is selected, the DON proposes to relocate, as appropriate, the USFWS facilities within the Ritidian Unit of the Guam NWR that would be encumbered by the range SDZs, and provide alternate public access to Ritidian Beach when the range is in use. Any decisions regarding the relocation of the USFWS facilities and/or construction to improve beach access at the Ritidian Unit of Guam NWR are dependent upon the outcome of consultations under section 7 of the ESA and negotiation of the agreement authorized by Section 2822 of the FY 2015 NDAA.

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Guam and CNMI Military Relocation
(2012 Roadmap Adjustments)
Supplemental Environmental Impact Statement

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Acronyms and Abbreviations

AAFB	Andersen Air Force Base
AAMDTF	Army Air and Missile Defense Task Force
ACE	Aviation Combat Element
ACHP	Advisory Council on Historic Preservation
ACM	asbestos-containing material
ADA	Americans with Disabilities Act
ADNL	A-weighted DNL
AGL	above ground level
AICUZ	Air Installation Compatible Use Zone
AIDS	Acquired Immune Deficiency Syndrome
ALPCD	Alien Labor Processing and Certification Division
AOC	Area of Concern
APHIS	Animal and Plant Health Inspection Service
APZ	Accident Potential Zone
ARPA	Archeological Resources Protection Act
ARTCC	Air Route Traffic Control Center
AT/FP	Anti-Terrorism/Force Protection
ATC	Air Traffic Control
ATCAA	Air Traffic Control Assigned Airspace
AVLA	Amphibious Vehicle Laydown Area
BA	Biological Assessment
BEQ	Bachelor Enlisted Quarters
BI	beneficial impact
BMP	Best Management Practice
BNOISE2	Blast Noise Impact Assessment
BO	Biological Opinion
BOQ	Bachelor Officer Quarters
C&D	construction and demolition
CAA	Clean Air Act
cal	caliber
CATM	Combat Arms Training and Maintenance
CDNL	C-weighted DNL
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CES/CEV	Civil Engineering Squadron Environmental Flight
CFA	Controlled Firing Area
CFR	Code of Federal Regulations
ChST	Chamorro Standard Time
CJMT	CNMI Joint Military Training
CLTC	Chamorro Land Trust Commission
cm	centimeter
CMCC	Civilian Military Coordination Council
CNIC	Commander, Navy Installations Command
CNMI	Commonwealth of the Northern Mariana Islands
CNO	Chief of Naval Operations
CO	carbon monoxide
CO_2	carbon dioxide
COMNAV	Commander Navy Region
CWA	Clean Water Act
CWCS	Comprehensive Wildlife Conservation Strategy
dB	decibels
dBA	A-weighted dB
dBC	C-weighted dB
DMM	discarded military munitions
DNL	day-night average sound level
DoD	Department of Defense
DoDEA	Department of Defense Education Activity
DOI	Department of the Interior
DON	Department of the Navy
DRMO	Defense Reutilization Marketing Office
DRS	Demand-Response Service
EA	Environmental Assessment
EAC	Economic Adjustment Committee
ECF	entry control facility
EDT	Eastern Daylight Time
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EMR	electromagnetic radiation
EO	Executive Order
EOD	Explosive Ordnance Disposal
EPP	Environmental Protection Plan
ERA	Ecological Reserve Area
ESA	Endangered Species Act
ESQD	Explosive Safety Quantity-Distance
ESS	Explosives Safety Submission
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FICUN	Federal Interagency Committee on Urban Noise
FL	flight level
FPCON	Force Protection Condition
FR	Federal Register
FTE	full time equivalent

FY	Fiscal Year
GALC	Guam Ancestral Lands Commission
GAR	Guam Administrative Rules and Regulations
GBHWC	Guam Behavioral Health and Wellness Center
GBSP	Guam Bureau of Statistics and Plans
GCA	Guam Code Annotated
GCC	Guam Community College
GDAWR	Guam Division of Aquatic and Wildlife Resources
GDISID	Guam Department of Integrated Services for Individuals with Disabilities
GDoC	Guam Department of Corrections
GDoE	Guam Department of Education
GDPHSS	Guam Department of Public Health and Social Services
GDPR	Guam Department of Parks and Recreations
GDPW	Guam Department of Public Works
GDYA	Guam Department of Youth Affairs
GEPA	Guam Environmental Protection Agency
GFCA	Guam Fishermen's Cooperative Association
GFD	Guam Fire Department
GHPI	Guam Historic Properties Inventory
GIP	Gross Island Product
GIS	geographic information system
GMHA	Guam Memorial Hospital Authority
GOV	government-owned vehicle
GovGuam	Government of Guam
GPA	Guam Power Authority
GPD	Guam Police Department
GPLS	Guam Public Library System
GRN	Guam Road Network
GRTA	Guam Regional Transit Authority
GWA	Guam Waterworks Authority
GWQS	Guam Water Quality Standards
GWRDG	Guam Water Resources Development Group
GWUDI	groundwater under the direct influence
ha	hectare
HACCP	Hazard Analysis and Critical Control Point
HAPC	Habitat Area of Particular Concern
HG	hand grenade
HMU	Habitat Management Unit
ID	identification
IFR	Instrument Flight Rules
ILS	Instrument Landing Systems
IMPLAN	Impact Analysis for Planning
iNFADS	internet Navy Facilities Asset Data Store
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
IT/COMM	information technology/ communications
JGPO	Joint Guam Program Office
JoG	Judiciary of Guam
JRM	Joint Region Marianas
KD	Known Distance
kg	kilogram
km	kilometer
kV	kilovolt
KW	kilowatt
LBP	lead-based paint
LEDPA	Least Environmentally Damaging Practicable Alternative
LEED	Leadership in Energy and Environmental Design
L_{eq}	equivalent sound level
LFTRC	live-fire training range complex
LID	Low Impact Development
LOS	level of service
LSI	less than significant impact
m	meter
m^3	cubic meter
MBTA	Migratory Bird Treaty Act
MC	munitions constituents
MCO	Marine Corps Order
MEC	munitions and explosives of concern
MGd	million gallons per day
MIRC	Mariana Islands Range Complex
MITT	Mariana Islands Training and Testing
MLd	million liters per day
mm	millimeter
MMRP	Military Munitions Response Program
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MOVES	Motor Vehicle Emissions Simulator
MPA	Marine Protected Area
MPMG	Multi-Purpose Machine Gun
MPPEH	material potentially presenting an explosive hazard
MRF	Modified Record of Fire
MSA	Munitions Storage Area

MSAT	mobile source air toxics
MSL	mean sea level
MSW	municipal solid waste
MTVR	Medium Tactical Vehicle Replacement
MUS	Management Unit Species
MW	megawatt
NA	not applicable
NAAQS	National Ambient Air Quality Standards
NAVFAC	Naval Facilities Engineering Command
NAVFIG	Naval Flight Information Group
NAVMAG	Naval Magazine
NDAA	National Defense Authorization Act
NEIC	National Enforcement Investigations Center
NEPA	National Environmental Policy Act
NEXRAD	Next-Generation Radar
NGLA	Northern Guam Lens Aquifer
NHPA	National Historic Preservation Act
NI	no impact
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOx	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NR	Not Reported
NRHP	National Register of Historic Places
NWF	Northwest Field
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
OEA	Office of Economic Adjustment
OEIS	Overseas Environmental Impact Statement
OPNAVINST	Chief of Naval Operations Instruction
ORC	Operational Range Clearance
OSHA	Occupational Safety and Health Administration
P	Present
PA	Programmatic Agreement
PAG	Port Authority Guam
PCB	polychlorinated biphenyl
PCE	primary constituent elements
pCi/l	picocuries per liter
PDIA	Potential Direct Impacted Area
PIIA	Potential Indirect Impacted Area
PM	particulate matter
$PM_{2.5}$	particulate matter less than or equal to 2.5 microns in diameter
PM_{10}	particulate matter less than or equal to 10 microns in diameter
POL	petroleum, oil, and lubricants
POV	privately owned vehicle
ppb	parts per billion
ppm	parts per million
PRTC	Pacific Regional Training Center
PTSD	Post-Traumatic Stress Disorder
QOL	quality of life
RAM	Random Antiterrorism Measures
RBP	Regional Biosecurity Plan
RC	Recently Completed
RED HORSE	Rapid Engineer Deployable Heavy Operational Repair Squadron Engineers
REVA	Range Environmental Vulnerability Assessment
RF	Reasonably Foreseeable
RMP	Range Mitigation Plan
ROD	Record of Decision
ROI	region of influence
RWY	Runway
SARNAM	Small Arms Range Noise Assessment Model
SAW	Squad Automatic Weapon
SCADA	Supervisory Control and Data Acquisition
SDDCTEA	Surface Deployment and Distribution Command - Transportation Engineering Agency
SDZ	surface danger zone
SEIS	Supplemental Environmental Impact Statement
SHPO	State Historic Preservation Officer
SI	significant impact
SIAS	Socioeconomic Impact Assessment Study
SI-M	significant impact but mitigable
SNCO	Staff Non-Commissioned Officer
SO_2	sulfur dioxide
SOGCN	Species of Greatest Conservation Need
SOP	standard operating procedures
SPAWAR	Space and Naval Warfare Systems Command
SPCC	Spill Prevention, Control, and Countermeasure
STD	sexually transmitted disease
STP	sewage treatment plant
SUA	Special Use Airspace

SWMP	Stormwater Management Plan
SWPPP	Stormwater Pollution Prevention Plan
TCP	Traditional Cultural Property
THAAD	Terminal High Altitude Area Defense
TMDL	Total Maximum Daily Load
tpy	tons per year
TRRA	Training Ranges Review and Analysis
U&SI	utilities and site improvements
UDP	Unit Deployment Program
UFC	Unified Facilities Criteria
$\mu g/m^3$	micrograms per cubic meter
UIC	Underground Injection Control
UoG	University of Guam
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UXO	unexploded ordnance
v/c	volume to capacity
VFR	Visual Flight Rules
VOC	volatile organic compound
WA	Warning Area
WERI	Water and Environmental Research Institute
WG	Wing
WWII	World War II
WWPS	wastewater pump station
WWTP	Wastewater Treatment Plant
yd^3	cubic yard

CHAPTER 1
PURPOSE OF AND NEED FOR THE PROPOSED ACTION

This chapter provides background for the Supplemental Environmental Impact Statement (SEIS) for the Guam and Commonwealth of the Northern Mariana Islands (CNMI) Military Relocation (2012 Roadmap Adjustments) SEIS, and describes the purpose and need for the proposed action to develop a cantonment area, family housing, a live-fire training range complex (LFTRC), and supporting infrastructure.

1.1 INTRODUCTION

In September 2010, the U.S. Department of the Navy (DON) signed a Record of Decision (ROD) (75 Federal Register [FR] 60438, September 30, 2010) (DON and U.S. Department of the Army 2010) regarding the 2010 Final Environmental Impact Statement (EIS) for the *Guam and CNMI Military Relocation; Relocating Marines from Okinawa, Visiting Aircraft Carrier Berthing, and Army Air and Missile Defense Task Force* (DON 2010). The ROD documented the DON's decisions regarding the 2006 Roadmap for Realignment Implementation, including the selection of specific alternatives analyzed in the 2010 Final EIS for the main base (cantonment area), aviation, and waterfront operations to support relocation of approximately 8,600 Marines and 9,000 dependents from Okinawa to Guam. The ROD deferred a decision on the specific site for an LFTRC. Regarding the establishment of the cantonment area, the ROD selected an area on federal lands under the custody and control of the Department of Defense (DoD) located at the Naval Base Guam, Telecommunications Site at Finegayan[4] (hereinafter "Finegayan") and the nearby South Finegayan Navy Housing site, as well as non-federal land known as the "former Federal Aviation Administration (FAA) parcel." The 2010 Final EIS identified this combined area as the preferred alternative for establishment of the cantonment area, including family housing.

In the months following issuance of the ROD, the DON formally committed that if the Route 15A area was selected for the LFTRC, the DON would provide for 24 hours a day, 7 days a week access to Pågat Village and Pågat Cave historical sites, to include the existing trail from Route 15A leading to both (DoD 2011, DON 2011; and see Appendix A). The DON, to meet this commitment, applied a probabilistic methodology to more precisely model the size of the surface danger zone (SDZ) associated with the Multi-Purpose Machine Gun (MPMG) Range, which would be part of the LFTRC. Application of this methodology reduced the size of the overall footprint and enabled the DON to take another look at potential LFTRC locations on Guam, including those locations previously considered but not carried forward for detailed analysis. This reevaluation resulted in the identification of additional LFTRC preliminary alternatives.

In light of this information, the DON initially elected to prepare an SEIS limited solely to the evaluation of potential impacts associated with the construction and operation of the LFTRC on Guam (hereinafter "LFTRC SEIS"). The DON issued its Notice of Intent (NOI) to prepare the SEIS in February 2012 (77 FR 6787, February 9, 2012) (see Appendix B). In the NOI, the DON preliminarily identified five potential alternatives for the range complex: two were adjacent to Route 15 in northeastern Guam, and three were located at or immediately adjacent to the Naval Base Guam, Munitions Site in southern Guam

[4] The names used throughout this SEIS for specific DoD properties on Guam were chosen to maintain consistency in planning and environmental documents, and may not be the official site names.

(hereinafter "Naval Magazine [NAVMAG]"). Public scoping meetings were conducted for the LFTRC SEIS in March 2012, and the public scoping comment period closed on April 6, 2012.

After the close of the public scoping comment period, on April 27, 2012, the U.S.-Japan Security Consultative Committee issued a joint statement announcing its decision to adjust the plans outlined in the May 2006 Roadmap for Realignment Implementation. In accordance with these 2012 Roadmap Adjustments, the DoD adopted a new force posture in the Pacific providing for a materially smaller and reconfigured force on Guam. In conjunction with changes to the mix of personnel involved in the relocation, the force adjustments would reduce the originally planned relocation of approximately 8,600 Marines with 9,000 dependents to a force of approximately 5,000 Marines with approximately 1,300 dependents. That decision prompted the DON's review of the actions previously planned for Guam and approved in the September 2010 ROD. This review concluded that while some actions remain unchanged as a result of the smaller force size, others, such as the size and location of the cantonment and family housing areas, could significantly change as a result of the modified force. Therefore, the DON published a new NOI on October 11, 2012 (77 FR 61746, October 11, 2012) and amended the scope of the ongoing LFTRC SEIS to add those actions that materially changed as a result of the new force posture (see Appendix B, and available for review at: http://guambuildupeis.us).

1.2 SCOPE OF THIS SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

The DON prepared this SEIS in accordance with the National Environmental Policy Act (NEPA) (42 U.S. Code [USC] §§ 4321, *et seq.)* and the Council on Environmental Quality's (CEQ's) implementing regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508). Pursuant to 40 CFR § 1502.9, the DON prepared this SEIS for the purpose of supplementing the portions of the 2010 Final EIS regarding the establishment on Guam of an LFTRC, a cantonment area, family housing, and associated infrastructure to support the relocation of a substantially reduced number of Marines and dependents than was previously analyzed. By supplementing the 2010 Final EIS, this SEIS advances NEPA's purpose of informing decision-makers and the public about the environmental effects of the DON's proposed action.

Pursuant to 40 CFR § 1502.21, this SEIS incorporates by reference the entire 2010 Final EIS and the September 2010 ROD. Compared to the 2010 Final EIS, this SEIS evaluates the potential environmental impacts of constructing and operating a smaller U.S. Marine Corps (hereinafter "Marine Corps") cantonment area, a smaller family housing area, a similarly sized LFTRC that has a smaller SDZ footprint (based on SDZ reduction achieved by applying the probabilistic methodology to the design of the MPMG Range), and infrastructure requirements to support a reduced number of relocating Marines and dependents than originally planned. The following considerations allowed for the development and evaluation of additional siting alternatives that were not considered feasible under the conditions evaluated in the 2010 Final EIS:

- Reduction in acreage requirements for the cantonment and family housing areas.
- Reconfigured SDZ footprint for the required LFTRC.
- Consideration of public input.
- Refinement of range designs.
- Reassessment of operational requirements, conflicts, and opportunities.

This Final SEIS evaluates five alternatives for the cantonment/family housing component of the proposed action, all of which are entirely contained within federally owned land parcels and two of which include locations on Guam other than Finegayan. In comparison, the 2010 Final EIS evaluated four site alternatives for cantonment that all involved the use of Finegayan (plus various combinations of non-

contiguous parcels to accommodate the needed family housing) and three of the four required the acquisition of non-federal land.

This Final SEIS evaluates five alternatives for the proposed LFTRC, all of which include a proposed stand-alone Hand Grenade (HG) Range at Andersen South. In comparison, the 2010 Final EIS evaluated two site alternatives for the LFTRC, including a separate proposed location for an HG Range at each site alternative.

The proposed change in size and composition of the new force structure and the reconsideration of the LFTRC SDZ footprint did not affect all of the decisions that were made in the September 2010 ROD. For example, the location of the Aviation Combat Element (ACE), the air embarkation facilities (Air Mobility Command Complex), the development of the North Gate and access road at Andersen Air Force Base (AAFB), the wharf improvements at the U.S. Navy (hereinafter "Navy") base at Apra Harbor, and the non-live fire and maneuver ranges on Andersen South remain unaffected by the changes in force structure resulting from the April 2012 Roadmap Adjustments. These actions are not dependent on (and would not be affected by) the ultimate locations of the cantonment/family housing areas and LFTRC on Guam. The potential environmental effects of these actions were fully and accurately considered and analyzed in the 2010 Final EIS. For those decisions that are not affected by the new force structure, the September 2010 ROD stands as the final agency action for those actions. The expanded scope of this SEIS does not include the transient aircraft carrier berthing in Apra Harbor or the U.S. Army (hereinafter "Army") Air and Missile Defense Task Force (AAMDTF).

The decision regarding training ranges on Tinian is not affected by the 2012 Roadmap Adjustments, and remains final and is not subject to reanalysis in this SEIS. However, in April of 2015 the DON published a combined Draft EIS and Overseas EIS (OEIS) for proposed CNMI Joint Military Training (CJMT) (hereinafter "CJMT EIS") on the islands of Tinian and Pagan. If implemented following completion of the CJMT NEPA process, the decision regarding proposed training ranges as evaluated in the CJMT EIS would supersede the 2010 ROD with regards to Tinian range projects. Consequently, the DON has deferred any implementation of the Tinian training ranges from the 2010 ROD pending the outcome of the CJMT EIS.

1.3 BACKGROUND

1.3.1 Overview of the 2010 Final Environmental Impact Statement

The 2010 Final EIS examined the environmental effects of a variety of complex multi-service actions, including components involving the Marine Corps, Navy, and Army, as well as existing U.S. Air Force (hereinafter "Air Force") assets on Guam. Given their temporal and geographic proximity, these actions were addressed in the same EIS. However, each component is based on a different national security objective, has an independent need for and independent utility from each other, and decisions were reached or will be reached on each component independently of the others. The three primary components of the proposed actions addressed in the 2010 Final EIS are briefly described below for each service. A detailed overview is contained in the 2010 Final EIS (Volume 1, Chapter 2: Overview of Proposed Actions and Volume 6, Chapters 1 and 2: Related Actions - Utilities and Roadway Projects).

Marine Corps. The Marine Corps component of the 2010 Final EIS focused on the 2006 Roadmap for Realignment Implementation to relocate Marine Corps forces, and included proposed development and operations on Guam and on the island of Tinian in the CNMI. The action included construction and operation of facilities and infrastructure to support approximately 8,600 Marines and their 9,000

dependents to be relocated to Guam (including cantonment, family housing, community support, and base support and administrative functions). These are the elements of the 2010 Final EIS that were revised in the 2012 Roadmap Adjustments and are reanalyzed in this SEIS. The 2010 Final EIS also included construction and operation of other required facilities and infrastructure to support the Marines' relocation to Guam (e.g., non-live fire and maneuver ranges, live-fire ranges on Tinian, aviation training areas, and several waterfront functions). These components of the action were not affected by the 2012 Roadmap Adjustments and are not reevaluated in this SEIS.

Navy. The Navy component of the 2010 Final EIS included construction of a new deep-draft wharf with shoreside infrastructure improvements, creating the capability in Apra Harbor to support extended aircraft carrier visits. This component of the 2010 Final EIS was not affected by the 2012 Roadmap Adjustments and is not reevaluated in this SEIS.

Army. The Army component of the 2010 Final EIS included development of facilities and infrastructure on Guam to establish and operate an AAMDTF to protect against the threat of ballistic missile attacks on Guam. This component also included the relocation of approximately 600 military personnel and their 900 dependents. This component of the 2010 Final EIS was not affected by the 2012 Roadmap Adjustments and is not reevaluated in this SEIS.

Related Actions - Utilities and Roadway Projects. The 2010 Final EIS (Volume 6: Related Actions - Utilities and Roadway Projects) also evaluated a series of related actions associated with the infrastructure requirements of the various action components. The EIS considered alternatives to satisfy both immediate and long-term needs of the relocation and to mitigate the effects of the increased demand on existing utilities and roadways systems on Guam. The 2010 Final EIS identified and evaluated the potential environmental impacts of several alternatives within each of the above categories of main components and related actions, and recommended preferred alternatives for possible inclusion in the ROD. In some cases, the scope of these requirements changed as a function of the 2012 Roadmap Adjustments, so utility and other infrastructure projects to support the Marine relocation are reevaluated in this SEIS.

1.3.2 Overview of the 2010 Record of Decision

In September 2010, the Assistant Secretary of the Navy for Energy, Installations and Environment signed the ROD documenting the DON's decisions relative to the Marine Corps and Navy components of the Proposed Action. The Commanding General for the 94th Army Air and Missile Defense Command also signed the ROD on behalf of the Army relative to its project component. The results of the ROD are described below and shown in Figure 1.3-1.

Marine Corps. In general, the ROD documented the DON's overall decision to proceed with the Guam and CNMI Military Relocation (2006 Roadmap for Realignment Implementation), as described in the 2010 Final EIS. Implementation of the relocation would include: (a) development and construction of facilities and infrastructure to support approximately 8,600 Marines and approximately 9,000 dependents being relocated from Okinawa to Guam; and (b) development and construction of facilities and infrastructure to support training and operations on Guam and Tinian. For some elements of the proposed action that did not require a choice of alternatives, such as the proposed training and maneuver facilities and operations at the NAVMAG area and at AAFB-Andersen South (hereinafter "Andersen South"), the ROD approved the proposed development and operations by virtue of their inclusion in the overall proposed action analyzed in the 2010 Final EIS. The ROD focused more specifically on the elements of the proposed action for which choices needed to be made from the range of alternatives presented in the 2010 Final EIS.

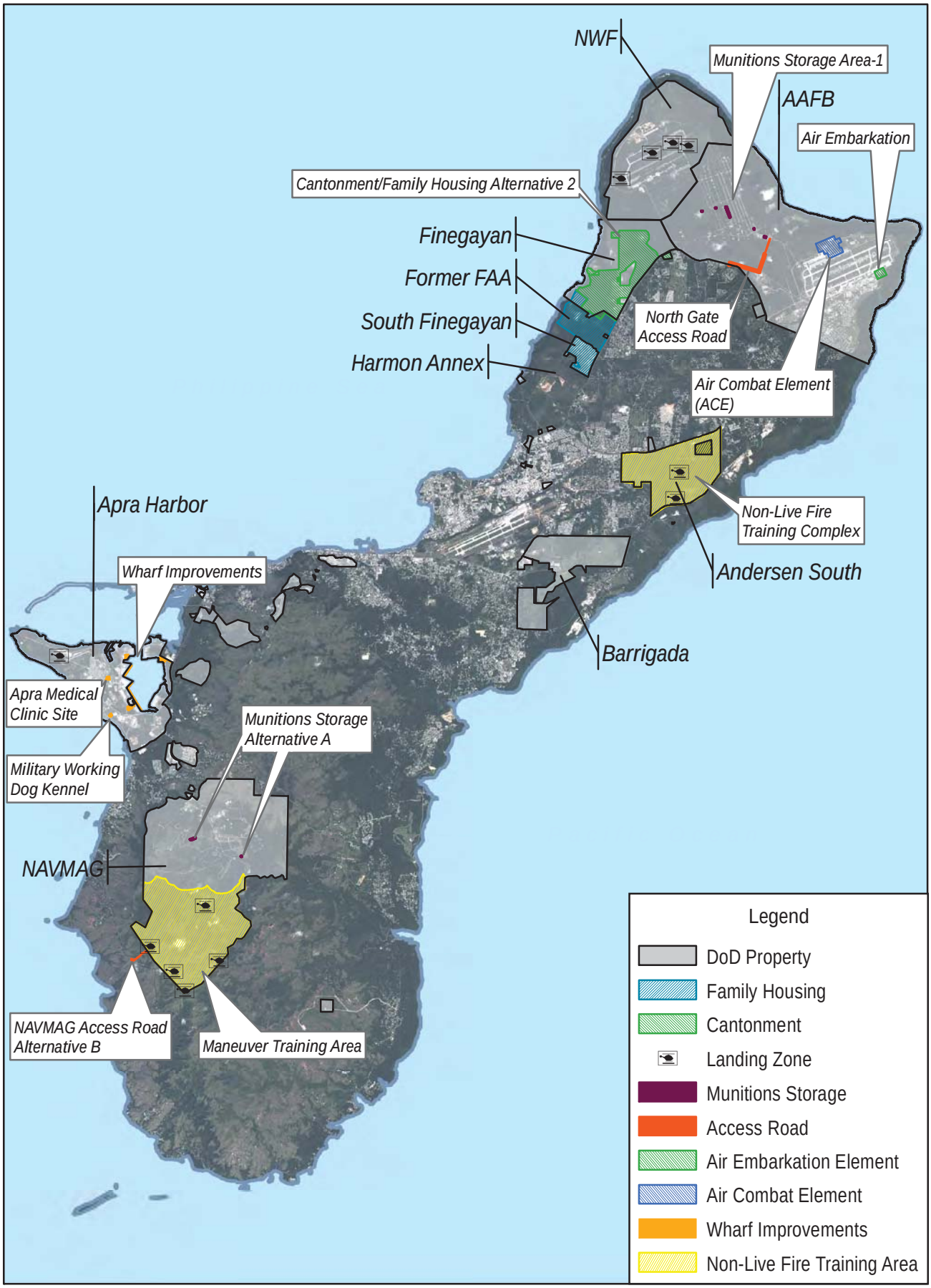


Figure 1.3-1
2010 Record of Decision: Marine Corps Relocation
Components Selected for Implementation

Specific ROD decisions for alternatives described in Volume 2 of the 2010 Final EIS included the following: (1) selection of a cantonment area utilizing federal lands at Finegayan and South Finegayan and acquisition of non-federal land known as the former FAA parcel; (2) access to the NAVMAG area using the existing hiking trail as the access road; (3) use of Parsons Road for the location of additional ammunition storage at NAVMAG area; (4) the beddown of the Marine Corps ACE and construction of associated ACE facilities at AAFB North Ramp, construction of air embarkation facilities at AAFB South Ramp, and construction of the North Gate and access road at AAFB; and (5) waterfront functions at Apra Harbor to support embarkation, including wharf and utility upgrades, associated dredging and dredge disposal management, relocation of military dog kennels, and construction of a medical/dental clinic. The ROD deferred a decision on the location of the LFTRC on Guam.

Decisions made in the ROD relative to Volume 3 of the 2010 Final EIS (Marine Corps Relocation - Training on Tinian) included the construction and operation of a Platoon Battle Course and Automated Combat Pistol/Military Police Firearms Qualification Course, an Automated Field Firing Range, and a Known Distance (KD) Rifle Range.

Decisions made in the ROD relative to Volume 6 of the 2010 Final EIS (Related Actions - Utilities and Roadway Projects) and solutions to meet required utilities improvements necessary to support the military buildup on Guam included the following: (1) power solutions, including reconditioning of up to five existing Guam Power Authority (GPA) combustion turbine power generation units, upgrades to power transmission and distribution lines to serve military needs at Apra Harbor, Finegayan, and AAFB; (2) potable water solutions, including the provision of additional potable water capacity of 11.3 million gallons per day (MGd) via the development of up to 22 new DoD water wells at AAFB, rehabilitation of existing wells, interconnects with the Guam Waterworks Authority (GWA) water system, and construction of associated treatment, storage, and transmission systems; (3) wastewater solutions, improvements to achieve secondary treatment standards, and expansion beyond the current design capacity at the Northern District Wastewater Treatment Plant (WWTP), improvements to the Northern and Central wastewater collection systems, and improvements to the Agaña WWTP to achieve secondary treatment standards; (4) solid waste solutions that would continue the use of the existing Navy Apra Harbor landfill until completion of the new Government of Guam (GovGuam) public landfill at Layon (since completed); and (5) roadway improvements, including roadway widening, intersection improvements, bridge replacements, pavement strengthening at specific locations island-wide, and military access points.

Navy. The DON elected to defer selection of a specific site for the construction and operation of a visiting aircraft carrier berth within Apra Harbor. The DON decided that the analysis presented in the 2010 Final EIS, including the marine resources impacts analysis, provided sufficient information to allow the DON to make a programmatic decision to locate a visiting aircraft carrier berth generally within Apra Harbor, which is the only deep draft harbor on Guam that could support such a berth. A final site selection would not occur until a site-specific NEPA analysis is conducted. There are currently no plans to conduct such an analysis.

Army. The Army selected the preferred alternative as described in the 2010 Final EIS (Volume 5: AAMDTF) and determined that it best represented how the Army could implement the action on Guam if the decision is made to assign the mission to the Army and if Guam is selected from those sites under consideration for an AAMDTF location. Since the 2010 ROD, the Army has deployed a Terminal High Altitude Area Defense (THAAD) Battalion, which would have been one of the three elements comprising the AAMDTF, as part of an expeditionary force to strengthen defense capabilities for American citizens

and U.S. Forces stationed on Guam. Any future plans to expand capabilities beyond the current expeditionary status to a permanent stationing would require a separate NEPA analysis from this SEIS. This separate NEPA analysis would be completed by the Army.

1.4 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

The purpose of the proposed action evaluated in this SEIS is to ensure that the relocated Marines are organized, trained, and equipped as mandated by 10 USC § 5063, to satisfy individual live-fire training requirements as described in the 2010 Final EIS and associated ROD, and to establish an operational Marine Corps presence on Guam in accordance with the April 2012 Roadmap Adjustments. The purpose remains unchanged from the 2010 Final EIS, albeit to support a materially smaller relocating Marine Corps force.

The proposed action is needed to ensure consistency with the new force posture adopted by the DoD in accordance with the April 2012 Roadmap Adjustments, which provide for a materially smaller force on Guam than was originally proposed in the 2010 Final EIS, while fulfilling U.S. national security obligations to provide mutual defense, deter aggression, and dissuade coercion in the Western Pacific Region.

1.5 NATIONAL ENVIRONMENTAL POLICY ACT COMPLIANCE

NEPA requires federal agencies to examine the environmental effects of the reasonable alternatives to implement a proposed action. The DON prepared this SEIS to identify and assess the potential environmental effects associated with the proposed construction and operation of an LFTRC on Guam that allows for simultaneous use of all firing ranges to support training and operations of the relocated Marines, a cantonment area of sufficient size and layout to provide military support functions, and family housing. The DON is the lead agency for preparation of this SEIS. The Office of the Secretary of Defense directed the DON to establish a Joint Guam Program Office (JGPO) to serve as the action proponent for the proposed action.

As the lead agency, the DON is responsible for consultation with other agencies, for coordination of appropriate environmental studies and evaluations, and for preparation of any NEPA-related determinations or documents in cooperation with other federal agencies.

1.5.1 Cooperating Agencies - Consultation and Coordination

Per 40 CFR § 1508.5, a cooperating agency "means any federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major federal actions significantly affecting the quality of the human environment."

The following federal agencies accepted the DON's invitation to participate as cooperating agencies for this SEIS (see also Appendix C):

- FAA
- Federal Highway Administration (FHWA)
- U.S. Department of the Air Force
- U.S. Department of Agriculture (USDA)
- U.S. Department of the Interior (DOI), Office of Insular Affairs

- U.S. Environmental Protection Agency (USEPA) Region 9

The cooperating agencies' participation in the NEPA process includes: (1) participating in a timely and effective manner; (2) advising JGPO on the scope of the proposal and analysis to be included in this SEIS; (3) providing comments on working drafts of this SEIS in a timely manner; (4) responding to JGPO requests for information; (5) participating, as necessary, in discussions on SEIS related issues; and (6) adhering to the overall schedule as set forth by JGPO.

The FAA provided consultation and advice on matters related to airspace management during the alternatives development process and provided comments on the Draft SEIS.

The USEPA commented extensively on the Draft SEIS and met with the DON in a series of meetings to receive and comment on additional information to address concerns on water and wastewater infrastructure, Northern Guam Lens Aquifer (NGLA) management, coordination with Guam Waterworks Authority (GWA), and groundwater monitoring. The USEPA also provided advice and technical review of the Northern District WWTP upgrades and associated impacts to the marine environment in support of DON's effects determination consultation with the National Marine Fisheries Service (NMFS) under the Endangered Species Act (ESA) and Magnuson-Stevens Fishery Conservation and Management Act for listed species and Essential Fish Habitat (EFH).

A similar process was undertaken with U.S. DOI agencies, including the National Park Service (NPS), U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service (USFWS) and Office of Insular Affairs to address most major comments related to water and wastewater infrastructure, public services, terrestrial and marine biological resources, Guam National Wildlife Refuge (NWR) mission and management activities, and cultural resources, among others. These cooperating agency engagements occurred from September 2014 through November 2014.

The USFWS declined the DON's invitation to be a cooperating agency, but has continued to collaborate with the DON with respect to the ESA section 7 consultation process, the National Wildlife Refuge System Administration Act, and relevant interagency agreements. The section 7 formal consultation involved the preparation of a Biological Assessment (BA) by the DON and will result in the issuance of a Biological Opinion (BO) by the USFWS. The DON provided its BA to the USFWS on October 1, 2014, and as of the publication of this Final SEIS continues to participate in the section 7 consultation process with the USFWS.

The DON has also engaged and received information from GovGuam agencies and other local organizations in conducting the studies necessary to develop this SEIS.

As described in Section 3.10, the 2011 Programmatic Agreement (PA) established a process for the review and analysis of potential effects to historic properties and other cultural resources for all alternative LFTRC locations. Beginning in October 2014, the DON consulted with the parties to the PA and the public on the Training Ranges Review and Analysis (TRRA), which provided information on potential adverse effects resulting from the construction and operation of the LFTRC alternatives to support consultation with the PA parties and the public.

1.5.2 Notice of Intent and Public Scoping

40 CFR § 1501.7 defines scoping as "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action." Scoping is an important aspect of the NEPA process. Scoping not only informs governmental agencies, interest groups, and the general public about the proposed action, but also helps the lead agency identify the issues and

concerns that are of particular interest to the affected populace. Noting the flexibility afforded by 40 CFR § 1502.9(c), the DON held public scoping periods for both the LFTRC SEIS and this SEIS for the 2012 Roadmap Adjustments due to the community's interest in the military buildup and the recognition that public input would be valuable in helping to shape the range of alternatives that would be analyzed in this SEIS.

The DON published an NOI for the LFTRC SEIS on February 10, 2012 (77 FR 6787, February 9, 2012), initiating a 56-day scoping period, which included three scoping meetings on Guam in March 2012. Over 300 people attended the three meetings and the DON received 151 comment letters (delineated into 348 unique comments) over the course of the scoping period. Of the 348 comments, approximately 24% of the comments related to the proposed actions and preliminary alternatives, followed by 16% about concerns with future recreational opportunities. Other concerns included potential impacts to real estate, historic properties, terrestrial biology, noise, transportation, public health and safety, and socioeconomics. A Scoping Summary Report was prepared and made available to the public following the February 2012 scoping period. It is included as an appendix to the Scoping Summary Report for the November 2012 scoping period for this SEIS (available on the project website at http://guambuildupeis.us).

After the scope of this SEIS was expanded to address the 2012 Roadmap Adjustments, scoping was reinitiated with the publication of an NOI on October 11, 2012 (77 FR 61746, October 11, 2012). The DON held three scoping meetings on Guam at the beginning of November 2012, which were attended by a total of 241 people. During the 60-day scoping period, the DON received 398 comment letters, including 10 duplicate comments, 131 identical form letters from members of the Community Advocates of the Raceway, and 52 comments from Community Advocates of the Raceway that attached signed petitions (collectively totaling over 13,000 signatures).

During scoping for this SEIS, comments were received from a variety of stakeholders and interest groups focusing primarily on the preliminary alternatives and/or specific resource issues. The highest percentage of comments (48%) related to concerns about the preliminary alternatives, with most comments focusing on the LFTRC preliminary alternatives. Many commented on the location of the preliminary LFTRC alternatives relative to populated areas. Some comments suggested that the LFTRC should be located on federal land. Others noted the potential impacts associated with the Northwest Field (NWF) and Route 15 LFTRC preliminary alternatives to historic or cultural sites (including in particular Pågat near the Route 15 alternatives), and potential impacts to recreational and commercial boating, diving, and fishing areas. Several commenters, including those associated with the Community Advocates of the Raceway, commented on the possible loss of the Guam International Raceway if the Route 15A area were selected for implementation and specifically identified the Finegayan and South Finegayan areas as preferred locations for proposed cantonment and NWF as a preferred location for the proposed LFTRC. Several comments suggested other alternatives, such as the CNMI, use of existing ranges on Guam, use of existing off-island ranges, and an option to split the LFTRC into separate ranges that could be built on existing federal land.

Comments regarding the cantonment area preliminary alternatives offered a variety of individual preferences for a preferred alternative. Overall, the comments recommended the use of existing federal land for the cantonment area. Other comments suggested the use of green buildings and renewable energy.

A Scoping Summary Report was prepared and made available to the public on the project website for this SEIS (http://guambuildupeis.us).

1.5.3 Draft Supplemental Environmental Impact Statement

A Draft SEIS was prepared in accordance with NEPA and the CEQ's implementing regulations and distributed for public and agency review on April 18, 2014 Eastern Daylight Time (EDT) (April 19, 2014 Chamorro Standard Time [ChST]). Concurrently, a Notice of Availability of the Draft SEIS was announced in the Federal Register (FR 79 21907, April 18, 2014 EDT) and local newspapers. The notice indicated locations (e.g., public libraries) where the Draft EIS was available to be reviewed, the duration of the public review and comment period, the available options for submitting comments, and the time and location of three scheduled public information meetings and public hearings on Guam. The public meetings/hearings provided an opportunity for interested parties to comment on the content of the Draft SEIS, which formed the basis for making subsequent changes in the Final SEIS.

The Draft EIS evaluated the potential environmental impacts of four alternatives for constructing and operating a cantonment area and family housing on Guam, five alternatives for constructing and operating an LFTRC, related utilities and infrastructure, and the No-Action Alternative. Project alternatives (including the No-Action Alternative) are described in Chapter 2.

The public comment period for the Draft SEIS was initially scheduled to last 60 days, with a published end date of June 16, 2014 EDT (June 17, 2014 ChST). The Draft EIS was made available for review on the SEIS website (http://guambuildupeis.us) and copies were sent to regulatory agencies, the Nieves M. Flores Memorial Library (Hagåtña) and the University of Guam (UoG) Robert F. Kennedy Memorial Library (Mangilao), elected officials (Governor, Legislature, and Mayors), and to individuals who requested copies during scoping.

The DON held three open house style meetings combined with three public hearings to both inform the public about the proposed action and identified impacts, and to receive written and verbal feedback about the Draft SEIS from the public. Informational posters were displayed, fact sheets about the project (including one translated into Chamorro) were handed out, and subject matter experts were available during each open house to answer questions on the Draft SEIS. Comment forms, a stenographer, and a Chamorro language translator were available during the open house portion of each meeting to receive written and oral comments. Oral comments were recorded during the public hearing portion of each meeting and transcripts of each hearing were later prepared for the record. The public meetings/hearings took place between May 17 and May 20, 2014 ChST as follows:

- Saturday, May 17, 2014 ChST at Okkodo High School in Dededo, with an open house from 1:00 p.m. to 3:00 p.m. and a public hearing from 3:00 p.m. to 5:00 p.m.
- Monday, May 19, 2014 ChST at the Father Dueñas Memorial School Phoenix Center in Chalan Pago, with the open house from 5:00 p.m. to 7:00 p.m. and the public hearing from 7:00 p.m. to 9:00 p.m.
- Tuesday, May 20, 2014 ChST at the former McCool School Gymnasium (Naval Base Guam - Santa Rita Annex, Naval Magazine Road, Santa Rita, with the open house from 5:00 p.m. to 7:00 p.m. and the public hearing from 7:00 p.m. to 9:00 p.m.

In addition to opportunities to submit either written or verbal comments during the three public meetings/hearings, other options for submitting comments during the public comment period included direct entry of written comments via the project website (including attachment of pre-written electronic files) and submittal of comment letters via mail.

In response to public comments the DON extended the public comment period for the Draft SEIS by 15 days to July 2, 2014 (ChST). Following the end of the extended public comment period, the DON

reviewed all written and verbal comments on the Draft SEIS and prepared responses to all comments (see Appendix G, Responses to Public and Agency Comments on the Draft SEIS). A total of 906 comment submissions were received from agencies and members of the public, including 286 via the project website, 36 written and 123 verbal comments at the three public meetings/hearings, and 461 comment letters via mail. An additional 20 comments were exact duplicates of comments already submitted by the same person, and two comments were entered by DON to test the website database. These 22 comments were not included in the total number of comments above. Of the total number of comments received (by all methods and at all venues), three verbal comments were expressed in the Chamorro language. All three of these comments were translated into English by a professional translator and responses are provided in Appendix G.

1.5.4 Final Supplemental Environmental Impact Statement

The DON prepared this Final SEIS by incorporating responses to public and agency comments on the Draft SEIS, refining and/or conducting additional project planning and analysis, and incorporating updated information. The Final SEIS was circulated in the same manner as the Draft SEIS.

The following lists key changes implemented between the Draft SEIS and the Final SEIS:

- Addition of a new cantonment/family housing Alternative E, which consists of a combination of the main cantonment at Finegayan that was previously analyzed in the Draft SEIS under Alternatives A and B, and the family housing at AAFB that that was analyzed in the Draft SEIS under Alternative C.
- Revisions to the description of the LFTRC Alternative 5 at NWF (and relevant analyses of impacts as appropriate) to reflect additional or adjusted planning features:
  - access to the beach and a vehicle access gate at the intersection of Beach Road and the SDZ;
  - four groundwater monitoring wells with access roads;
  - a third range observation tower and access road;
  - additional water and wastewater utility lines within the project boundary; and
  - removal of the existing USFWS facilities and a proposed water tank from the impacted area.
- A small adjustment in the construction area footprint for the proposed HG Range, representing an increase of one acre compared to the area considered in the Draft SEIS.
- Expansion of the Land and Submerged Land Use sections to specifically address public access restrictions as they relate to fishing and other recreational activities.
- Addition of an analysis of potential impacts to the Guam Customs and Quarantine Agency's key professional staffing requirements at the Port of Guam in the Socioeconomics sections.
- Revision of the impact assessment regarding the Northern District Wastewater Collection System in light of newly available information from closed-circuit television footage on the sewer line conditions from AAFB to the Northern District WWTP along Routes 3 and 9. This concrete reinforced pipe is in a state of deterioration that requires rehabilitation or replacement. Thus, this impact assessment has been revised to significant but mitigable.
- Update to the potential layout of the proposed water well area at AAFB.
- Addition of Appendix G to provide a record of all comments received during the Draft SEIS public comment period and the DON's response to each comment.

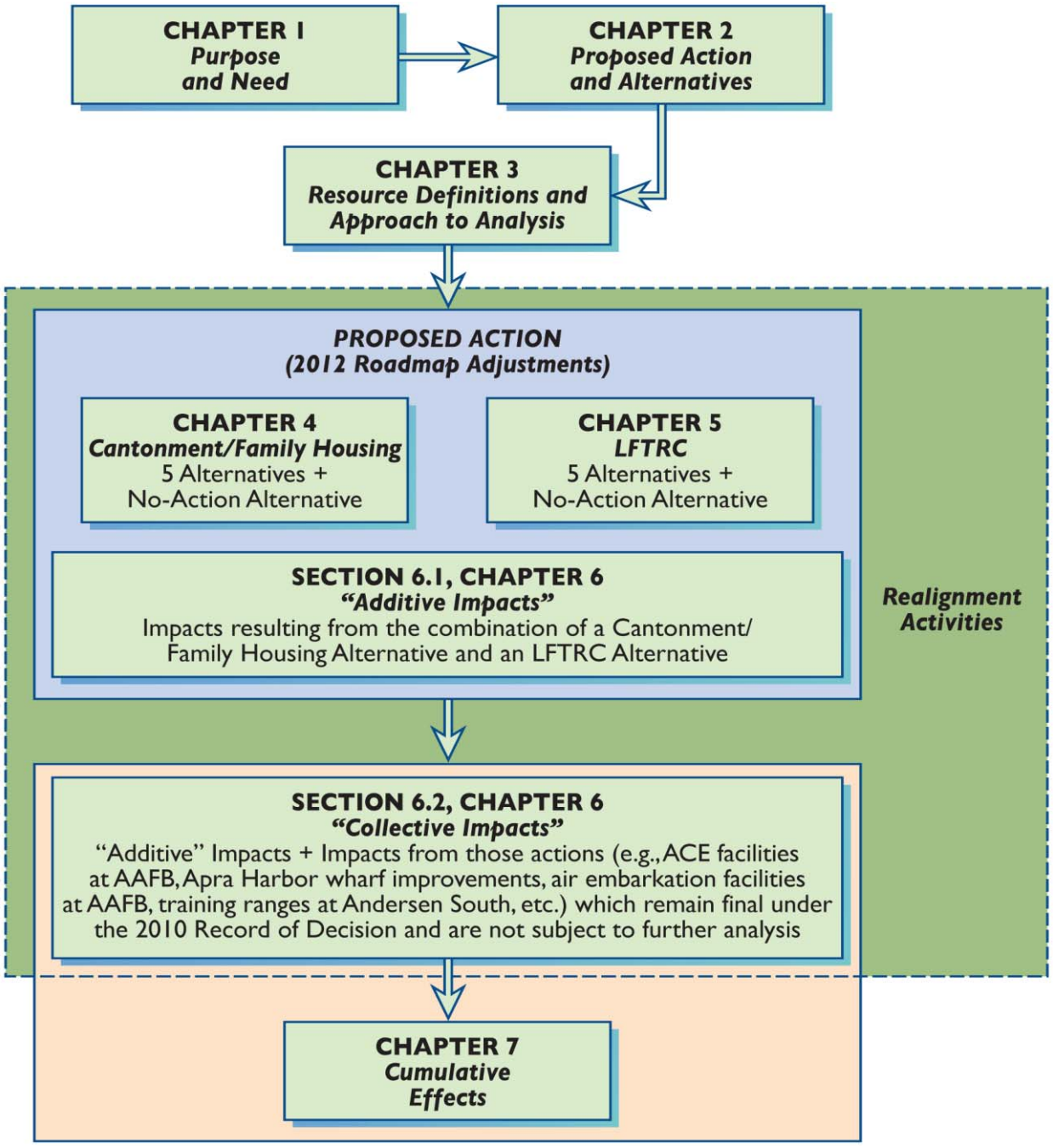
1.5.5 Record of Decision

The DON will prepare a ROD that reflects the final decisions on the proposed action, the rationale behind those decisions, and any commitments to monitoring and mitigation. The DON will issue the ROD

following the issuance of the Final SEIS and a 30-day waiting period. The ROD will be published in the Federal Register, distributed to agencies and interested parties, and posted on the SEIS website. An announcement regarding the availability of the ROD will also be published in local newspapers and the project website.

1.6 ORGANIZATION OF THE SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

This Final SEIS describes the affected environment and the impact analyses for all alternatives. The organization of this SEIS, focusing in particular on the interrelationships between Chapters 1 through 7, is shown in the diagram below, followed by a short description of each chapter.



Chapter 1 explains the background of the Guam and CNMI Military Relocation (2012 Roadmap Adjustments) SEIS, and describes the purpose of and need for the proposed action to develop a cantonment/family housing area, an LFTRC, and supporting infrastructure.

Chapter 2 identifies the alternatives that are carried forward for analysis in this SEIS, including the No-Action Alternative, identifies the DON's preferred alternative, and explains why certain alternatives were considered but then eliminated from further analysis. This chapter also includes an overview of the Best Management Practices (BMPs) that would be incorporated into the proposed action and that were factored into the impact analyses in this SEIS.

Chapter 3 introduces each of the environmental resources on Guam that are evaluated in this SEIS. Each resource is defined in terms of its key characteristics and relevant issues of concern given the nature of the proposed action (e.g., facility construction, military base operations and training) and public input provided during the scoping process. The regulatory framework that exists to preserve, protect, and identify potential impacts to each resource is also described, followed by the approach and impact assessment criteria that were applied in the analysis of potential effects on each resource.

Chapter 4 describes the affected environment and environmental consequences associated with the implementation of each of the cantonment/family housing alternatives.

Chapter 5 describes the affected environment and environmental consequences associated with the implementation of each of the LFTRC alternatives.

Chapter 6 evaluates the "additive" impacts (i.e., those in addition to the impacts described in Chapters 4 and 5) that would result when a particular cantonment/family housing site alternative is paired with a particular LFTRC alternative (including the effects of installing communications infrastructure required to connect a cantonment/family housing area to an LFTRC and to link both facilities to other DoD facilities on Guam). Chapter 6 also addresses the "collective" impacts of combining the proposed actions evaluated in this SEIS with those actions which remain final under the 2010 ROD and are not subject to further analysis in this SEIS (e.g., ACE facilities at AAFB, Apra Harbor wharf improvements, air embarkation facilities at AAFB, training ranges at Andersen South).

Chapter 7 discusses the cumulative effects of implementing the 2012 Roadmap Adjustments in conjunction with those projects that remain final under the 2010 ROD and other past, present, and reasonably foreseeable future projects on Guam. The DON acknowledges a general trend towards incorporating the cumulative analysis into the discussion of direct and indirect impacts of an action. However, because of the unique nature of this SEIS (i.e., it supplements a majority of the original 2010 action, presents numerous feasible combinations of cantonment and LFTRC alternatives, and acknowledges relevant additive and collective impacts), the DON decided to address cumulative effects in a separate chapter to facilitate readability.

Chapter 8 addresses additional considerations required by NEPA.

Chapter 9 provides a list of the references cited in this SEIS.

Chapter 10 provides a list of preparers of this SEIS.

Appendices cover public involvement, agency consultation, and select technical supporting documentation. The appendices complement and expand upon the information provided in this SEIS.

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CHAPTER 2
PROPOSED ACTION AND ALTERNATIVES

This chapter presents an overview of each component of the proposed action (including relevant changes since the 2010 Final EIS), describes the No-Action Alternative to the proposed action, and summarizes the alternatives screening process and criteria used to develop and evaluate a set of preliminary alternatives for implementing the proposed action. This chapter then describes in more detail the reasonable alternatives that are carried forward for analysis in this SEIS, identifies the DON's preferred alternative, and explains why certain alternatives were considered but then eliminated from further analysis. Lastly, this chapter summarizes the BMPs that would be incorporated into the proposed action and that were factored into the impact analyses presented in later chapters of this SEIS.

2.1 NO-ACTION ALTERNATIVE

Under the No-Action Alternative, the DON would continue to implement the September 2010 Final EIS and ROD. The decision to construct and operate the LFTRC would remain deferred, and the DON would establish a cantonment/family housing area for a larger force of approximately 8,600 Marines and approximately 9,000 dependents on federally controlled lands at Finegayan and South Finegayan and by acquiring land known as the former FAA parcel. Although the No-Action Alternative presumes the present course of action identified in the September 2010 ROD, for purposes of assessing the environmental impacts of the proposed alternatives in this SEIS, the DON compared the impacts of the proposed action to the baseline conditions identified in the 2010 Final EIS. Baseline conditions were updated in this SEIS, as appropriate, if new information was available. The No-Action Alternative is not a reasonable alternative as it would not meet the purpose and need for the proposed action as defined in Chapter 1 of this SEIS. Foremost, it would be inconsistent with the new force posture adopted by the DoD in accordance with the April 27, 2012 Roadmap Adjustments, which provide for a materially smaller relocated force on Guam. Furthermore, the No-Action Alternative would neither satisfy the training requirements for the relocated Marines as mandated by 10 USC § 5063 nor satisfy the individual live-fire training requirements as described in the 2010 Final EIS and ROD.

2.2 OVERVIEW OF THE PROPOSED ACTION

The proposed action is to construct and operate a cantonment area, family housing, and an LFTRC on Guam to support the Marine Corps relocation. To meet the purpose of and need for the proposed action (as described in Section 1.3), the Marine Corps requires facilities that can fully support the missions of the relocated units. These requirements include a cantonment area, family housing and community support facilities of sufficient size and functional organization to accommodate the reduced number of Marines relocating to Guam per the 2012 Roadmap Adjustments, and an LFTRC that allows for simultaneous use of firing ranges to support training and operations of the relocated Marines. The proposed action also includes the provision of on-site utilities, access roads, and related off-site infrastructure to support the cantonment/family housing and LFTRC. The sections below describe each of the SEIS action components in more detail.

2.2.1 Relocation of Marines and Associated Population Change

The proposed Marine Corps relocation to implement the 2012 Roadmap Adjustments would consist of approximately 5,000 Marines accompanied by approximately 1,300 dependents, a 64% reduction in the relocated Marine Corps population compared to the proposed relocation in the 2010 Final EIS (see Section 1.1). Approximately one-third of the relocating active duty Marines would be Permanent Change of Station personnel. The designation "Permanent Change of Station" refers to the official relocation of an active duty military service member to a different duty station, along with any dependents. The Permanent Change of Station personnel would be assigned to Guam for an average period of 3 years and may be accompanied by dependents.

The remaining two-thirds (approximately) of the relocating active duty Marines would be personnel in the Unit Deployment Program (UDP). The UDP is a system for assigning and sequencing the deployments of Marines to reduce the number of unaccompanied tours of duty, reduce personnel turnover within a unit, and enhance unit readiness by stabilizing the unit's assigned personnel prior to deployment, thereby improving unit continuity. The UDP personnel would be deployed to Guam for periods of approximately 6 months, and would not be accompanied by dependents. As each UDP unit is deployed off-island, another unit would be rotated to Guam so the overall number of UDP personnel would remain relatively constant. A unit would be manned with deployable Marines approximately 180 days from the scheduled deployment date. Units deploying to Guam under the UDP would arrive aboard aircraft contracted through the Air Force's Air Mobility Command. Those same aircraft would then accommodate the outgoing unit for its return to either the continental U.S. or Hawaii. Individual UDP units would arrive and depart at staggered intervals so as to not create any gaps in readiness of the overall force, and would not all arrive at once and/or on the same day. For example, the two infantry battalions would stagger their arrival and departure by approximately 3 months and would not change at the same time. Equipment sets, including aircraft, for the UDP units would be permanently based in Guam and would not rotate with the units. Each incoming (and outgoing) unit would send an advance party to Guam (and the departing unit's next duty station) approximately 30 days prior to the main unit arrival to facilitate the inventory and turnover of equipment from the outgoing to incoming units. There would be no requirement for more bachelor quarters since the incoming/outgoing units would arrive and depart on the same day. Also, since both the incoming and outgoing units would send advance parties, there should be no short term personnel surge during that period.

The direct population influx associated with Marine Corps uniformed personnel would be supplemented by civilian military workers and off-island construction workers, as well as indirect and induced population that would be associated with economic growth from the proposed action (along with dependents for each).

Table 2.2-1 presents the estimated total population increase on Guam that would occur as a result of the proposed action[5]. SEIS project-related construction work is expected to begin in 2015, increase substantially over a period of about 2 years, and then enter a period of relatively consistent construction activity between 2017 and 2023. Construction activity would begin to decrease substantially from 2024 until the final year of construction in 2027. Based on the projected construction schedule, sufficient facilities and infrastructure will have been developed to allow the first major influx of Marines and their families by 2020 (an increase of about 2,600 Marines from 2019 to 2020). Additional Marines and their dependents would continue to arrive on Guam through 2026, at which time the Marine Corps presence on Guam would achieve a steady-state population going forward.

Table 2.2-2 also compares the population increase associated with the current proposed action to the increase projected in the 2010 Final EIS. As graphically shown in Figure 2.2-1, the analysis of population growth in the 2010 Final EIS showed a rapid increase in the first 5 years of the relocation, a peak, and then a sharp decline into a steady state population increase of more than 33,000 new residents compared to the baseline population. The sharp increase and decline were forecast because the original planned construction period was intense and extremely short (which would have required the influx and subsequent outflow of large numbers of off-island construction workers over a relatively short period), and would have coincided with the arrival of Marines and their families. The proposed action evaluated in the 2010 Final EIS also included non-Marine Corps actions (e.g., AAMDTF and carrier berthing at Apra Harbor) involving both construction and additional population. As previously noted, there are currently no plans to implement these actions. This SEIS proposed action includes a relatively longer and more gradual construction period, resulting in a smaller requirement to bring in off-island construction workers. As shown in Figure 2.2-1, this extended construction period and reduced number of relocated personnel are forecast to generate a much smaller and more gradual overall increase in population, rather than a peak. Additional details about the anticipated population increase related to the proposed action are presented in the Socioeconomic Impact Assessment Study in Appendix D.

[5] The estimated population changes on Guam and corresponding impacts analysis in this SEIS is based on Marine Corps relocation planning assumptions developed in early 2013. The DON anticipates that refinements to the planning assumptions will occur periodically over the course of preparation of this SEIS (through 2015) and proposed action (2015-2027). However updating the analysis during preparation of this SEIS based on small adjustments to Marine Corps implementation planning assumptions was not deemed practical and/or necessary.

Table 2.2-1. Estimated Total Population Increase[1] from the SEIS Proposed Action (Relative to Base Year 2014)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*
Direct Population														
Active Duty Marine Corps	25	35	35	35	387	2,990	3,319	3,319	4,282	4,282	4,779	5,000	5,000	5,000
Marine Corps Dependents	8	11	11	11	118	908	1,008	1,008	1,300	1,300	1,300	1,300	1,300	1,300
Civilian Military Workers	4	5	38	75	113	150	188	225	263	300	338	338	338	338
Civilian Worker Dependents	4	5	35	71	107	143	179	214	249	285	320	320	320	320
Off-Island Construction Workers	161	1,071	2,301	3,227	2,871	2,587	3,175	2,978	2,205	1,350	618	46	0	0
Construction Worker Dependents	56	343	667	839	660	517	635	596	507	351	179	15	0	0
Direct Marine Corps Relocation Subtotal	**258**	**1,470**	**3,087**	**4,259**	**4,256**	**7,295**	**8,504**	**8,339**	**8,806**	**7,868**	**7,533**	**7,019**	**6,959**	**6,959**
Indirect and Induced Population														
Off-Island Workers for Indirect/Induced Jobs	46	130	271	338	349	455	548	529	462	361	308	257	228	227
Dependents of Off-Island Workers for Indirect/Induced Jobs	43	124	260	325	337	441	533	517	453	355	304	255	227	227
Indirect/Induced Subtotal	**89**	**254**	**531**	**663**	**686**	**897**	**1,082**	**1,046**	**915**	**716**	**612**	**513**	**455**	**453**
Total Population Increase[1]	**347**	**1,724**	**3,618**	**4,922**	**4,941**	**8,191**	**9,585**	**9,386**	**9,721**	**8,584**	**8,145**	**7,532**	**7,414**	**7,412**

Note: [1] Population increases shown are not additive from year to year. They represent the aggregate project-related increase as of any given year (relative to the Base Year 2014 population before project implementation), and not an annual increase.
Source: Socioeconomic Impact Assessment Study (Appendix D of this SEIS).

Table 2.2-2. Total Project-Related Population Increase[1] on Guam: Comparison of the 2010 Final EIS to SEIS Proposed Actions

	2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*
2010 Final EIS																			
Total Increase	11,038	27,835	44,301	52,575	79,178	64,918	41,919	33,431	33,431	33,608	33,608	33,608	33,608	33,608	33,608	33,608	33,608	33,608	33,608
2012 Roadmap Adjustments SEIS																			
Total Increase	0	0	0	0	0	347	1,724	3,618	4,922	4,941	8,191	9,585	9,386	9,721	8,584	8,145	7,532	7,414	7,412

Note: [1]Population increases shown are not additive from year to year. They represent the aggregate project-related increase as of any given year (relative to the Base Year population before project implementation), and not an annual increase.
Sources: 2010 Final EIS (Volume 9, Appendix F); Socioeconomic Impact Assessment Study (Appendix D of this SEIS).

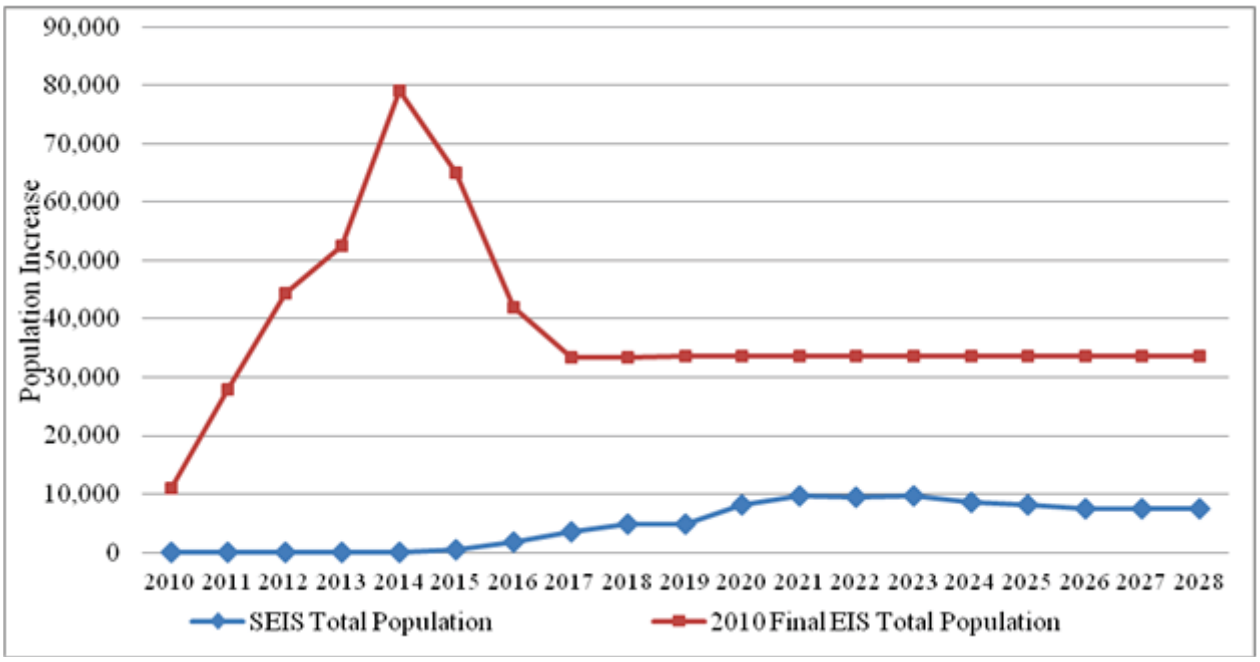


Figure 2.2-1 Comparison of Project-Related Population Increase on Guam: 2010 Final EIS and 2012 Roadmap Adjustments SEIS

2.2.2 Cantonment and Family Housing

The proposed cantonment and family housing would provide essential base operations and support facilities and functions, including, but not limited to:

- Headquarters and administrative support.
- Supply, service, maintenance, and storage facilities (including uncovered, paved open storage areas).
- Some site-specific training functions (classroom and other non-live fire) and open space (e.g., parade grounds, and training areas).
- Housing for unaccompanied personnel (Bachelor Officer, Bachelor Enlisted, and Transient)
- Family housing[6].
- Community support facilities (e.g., retail, educational, recreational, medical, day care, and religious facilities).

[6] The SEIS assumes construction of 535 family housing units to support the Marine Corps relocation to Guam. This estimate was based on planning assumptions identified early in the SEIS process. In June 2013, Commander, Navy Installations Command prepared a Guam Housing Study that concluded that, given existing and planned DoD housing inventories, less homes may be required to support the Marine Corps relocation. However, recognizing that family housing assumptions and conditions will continue to evolve over the course of the Marine Corps relocation, this SEIS conservatively assumes construction of 535 family housing units.

These categories of functions are generally consistent with those that were included in the proposed action for the 2010 Final EIS, but the relative size of the required cantonment area is considerably reduced in this SEIS given the reduced size and adjusted composition of the relocating force. For example, as shown in Figure 2.2-2, the development footprint of the cantonment/family housing area that was selected in the 2010 ROD (which also represents the No-Action Alternative in this SEIS) is almost 78% larger than a representative SEIS alternative at Finegayan (details are presented in Section 2.4.4 later in this chapter). The impacted area of the 2010 ROD alternative would also require acquisition of 680 acres (275 hectares [ha]) of land not already under the custody and control of the DoD (known as the former FAA parcel), whereas the SEIS alternatives would require no acquisition of such lands. The 2010 Final EIS (Volume 2, Chapter 2: Description of Proposed Action and Alternatives, Section 2.2: Main Cantonment Area Functions, pages 2-22 and 2-23) describes the required facilities for the cantonment area in more detail.

The proposed action also includes installation of on-site utilities to support the cantonment and family housing facilities, as well as off-site utilities to connect the proposed facilities with existing island infrastructure, and to link proposed facilities (e.g., for communications) with other DoD facilities on Guam. Brief overviews of the proposed utility components that would be the same for any project alternative are provided below in Section 2.2.4. Additional site-specific details are included with the description of each project alternative in Sections 2.4 and 2.5.

In addition to the proposed construction of cantonment and family housing facilities and supporting utility infrastructure, the proposed action would also include the expansion or realignment of two existing off-site school facilities. The existing Department of Defense Education Activity (DoDEA) High School located at the Naval Hospital site on central Guam would be expanded to accommodate additional students associated with the relocated Marine Corps families on Guam. The existing Andersen Middle School on AAFB would, depending on the alternative selected, either be expanded to accommodate additional students or be repurposed as an elementary school and a new middle school would be constructed nearby. The proposed school upgrades would include new structures, open space, and parking area and are described in more detail in Section 2.4.4.6. Additional site-specific details of the proposed action are described in Section 2.4.4 for each cantonment/family housing alternative carried forward for analysis in this SEIS.

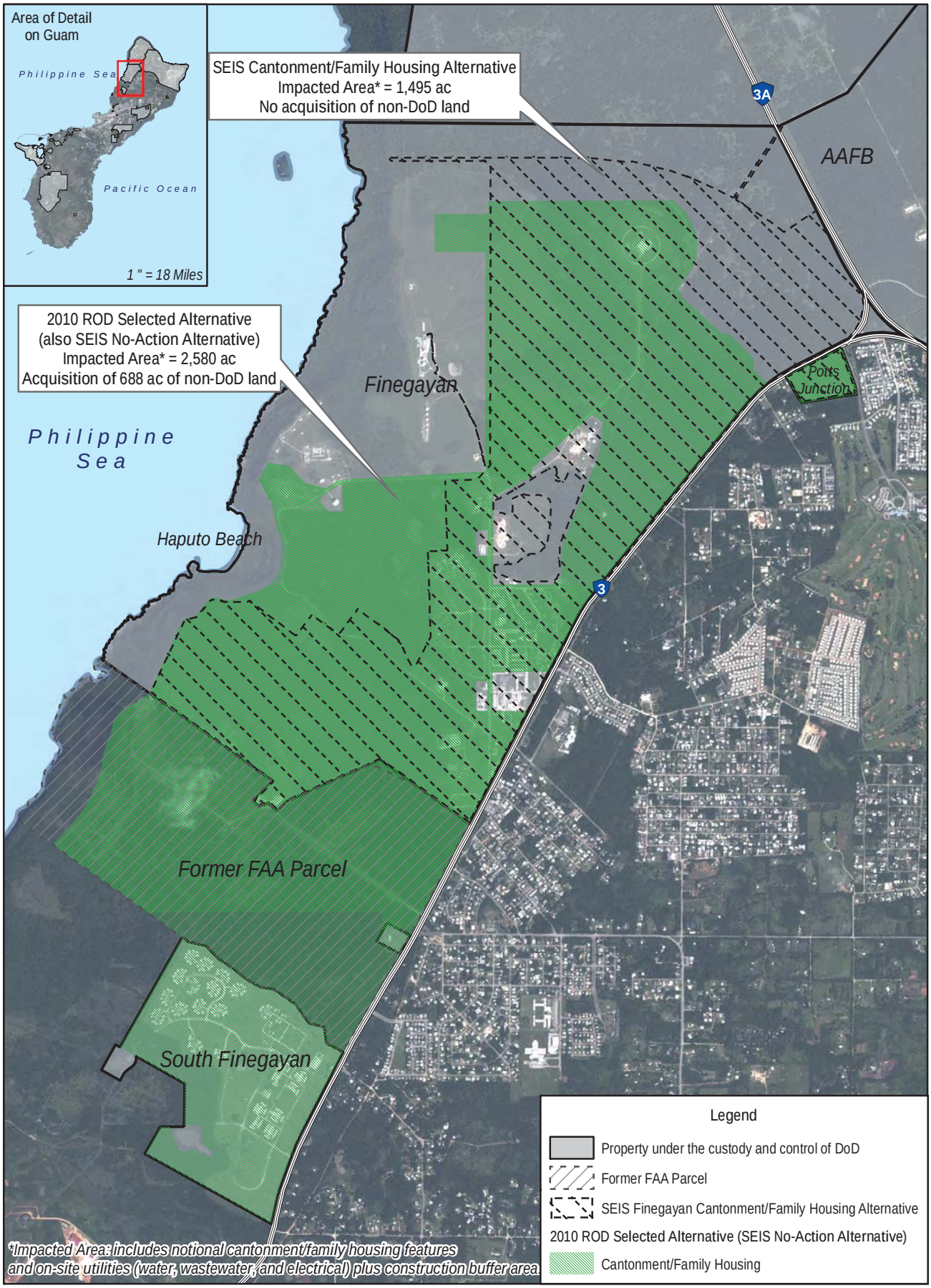


Figure 2.2-2
Comparison of an SEIS Cantonment/Family Housing Alternative to the Alternative Selected in the 2010 ROD

2.2.3 Live-Fire Training Range Complex

The proposed action includes construction and operation of live-fire training ranges and associated range operation and control facilities (e.g., range administration building, range maintenance building, observation towers) to meet the individual weapons training/qualification requirements of the Marine force. Photo 2-1 illustrates the standard features of a live-fire training range. The proposed LFTRC would include the following ranges:

- *KD Rifle Range:* The proposed KD Rifle Range would have 50 firing points for 5.56-millimeter (mm) weapons. The range would be 178 yards (163 meters [m]) wide and 500 yards (457 m) from the farthest firing line to the target line). The target line would be flush with the ground, and there would be level ground from the 200 yard (183 m) firing line to the target line. The range would include a 25-foot (8-m) tall impact berm behind the target line. The range footprint would encompass approximately 18.5 acres (7.5 ha).

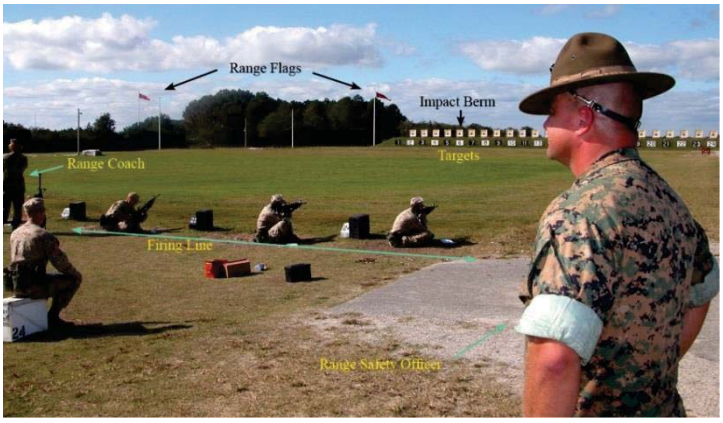


Photo 2-1. Standard Features of a Live-Fire Training Range

- *KD Pistol Range:* The KD Pistol Range would provide 25 firing points for training with 9-mm and 0.45-caliber (cal) weapons. The range would be 41 yards (37.5 m) wide by 50 yards (46 m) long with level ground from the firing line to the target line. The range would include a 12-foot (4-m) tall impact berm behind the target line and 12 foot (4 m) lateral berms. The range footprint would encompass approximately 0.4 acres (0.2 ha).
- *Non-standard Small Arms Range*: The Non-standard Small Arms Range would provide 25 firing points, and be used for training with 5.56-mm weapons. The range would be 68 yards (62.5 m) wide by 109.4 yards (100 m) long with level ground from the 91 m firing line to the target line. There would be a 16 foot (5 m) tall impact berm behind the target line, and 16 foot (5 m) lateral berms. The range footprint would encompass approximately 1.5 acres (0.6 ha).
- *Modified Record of Fire Range (MRF)*: The proposed MRF Range would have 16 firing points for use by 5.56-mm weapons. This live-fire range area would be 175 yards (160 m) wide by 219 yards (200 m) in length with a 25 foot (8 m) tall impact berm at the far end of the range. The range footprint would encompass approximately 7.9 acres (3.2 ha).
- *MPMG Range*: The proposed MPMG Range would have eight stationary firing lanes to support training with 5.56-mm, 7.62-mm, and 0.50-cal weapons, and 40-mm inert training rounds (i.e., non-explosive). The range would be 175 yards (160 m) wide at the firing line, expanding to 350 yards (320 m) wide at the far end of the range. The range would be 1093.6 yards (1,000 m) long and would include a 25 foot (8 m) tall impact berm at the far end of the range. The range footprint would encompass approximately 59 acres (24 ha).

The LFTRC would include a range operations tower, a target storage and maintenance sheds, ammunition issue points, covered bleachers, portable toilets, perimeter fencing, safety signage and lighting, and parking. Range footprints would be entirely cleared of vegetation and the range would be designed so that

expended rounds of ammunition would be contained by berms within the footprint. Following construction, some non-invasive grassy vegetation may be introduced for erosion and storm water control in some areas of the range footprint in keeping with the Guam landscaping guidelines.

In addition to the five ranges collocated within the proposed LFTRC, the proposed action also includes construction and operation of a separate HG Range at Andersen South. The proposed HG Range would include an area developed as a hand grenade training complex for the M67 fragmentation grenade. The following features would be developed within the hazard zone: a holding shelter for four persons, four throwing positions with grenade sumps, a range control tower with ballistic glass, and a grenade dudded impact area. A grenade house would be collocated with the grenade throwing pits. There would also be a concrete munitions storage facility (i.e., magazine) surrounded on three sides by earthen berms for the temporary storage of hand grenades during training events. In addition to the live-fire area, there would be a non-live fire training area developed adjacent to the range and outside of the SDZ. The training area would consist of a demonstration area with bleachers, an open practice throwing field with various targets and throwing positions, portable toilets, and a parking area. Inert practice grenades would be used at this training area to provide familiarization training prior to proceeding onto the live-fire grenade range.

The LFTRC and the HG Range would be managed in accordance with current Marine Corps range management policies and procedures, which are designed to ensure the safe, efficient, effective, and environmentally sustainable use of the range area. A thorough explanation of range management is detailed in the 2010 Final EIS (Volume 2, Chapter 2: Description of Proposed Action and Alternatives, Section 2.3.1.4: Firing General Military Skills, pages 2-58 to 2-59). The same range management activities presented in the 2010 Final EIS would be applied (with any applicable updates) to the LFTRC and HG Range proposed in this SEIS. These would include a range safety program, range maintenance, scheduling, access control, fire management, and environmental protection and monitoring activities.

The individual ranges within the LFTRC would be designed and constructed with berms up to 25 feet (7.62 m) in height to contain expended ammunition within the range footprint. However, it is possible (although highly unlikely) that a round may ricochet or fragment and land outside the range footprint. In accordance with Marine Corps Order (MCO) 3570.2J, a safety area called an SDZ is established for each range. An SDZ is an area associated with a training range that is designed to protect people during weapons training. It may include land, water, and airspace. When a range is in active use, the SDZ is an exclusion area that is strictly controlled and could contain projectiles, fragments, or components from weapons firing. SDZs are only restricted when the associated range is in use.

The acreage requirements for the live-fire training ranges and associated SDZs are shown in Table 2.2-3.

Table 2.2-3. Size of Live-Fire Training Ranges and Associated SDZs

Weapons Range	*Range Footprint (acre / ha)*	*SDZ (acre / ha)*
KD Rifle Range	18.5 / 7.5	997 / 404
KD Pistol Range	0.4 / 0.2	249 / 101
Non-standard Small Arms Range	1.5 / 0.6	763 / 309
MRF Range	7.9 / 3.2	887 / 359
MPMG Range[1]	59.0 / 24.0	2,768 to 3,458 / 1,120 to 1,399
HG Range at Andersen South	24.0 / 9.7	30.7 / 12.4

Note: [1]The SDZs for the MPMG Range were determined using probabilistic modeling based on-site-specific characteristics. The Probabilistic SDZ varies for each alternative. Therefore, the low and high acreages for the SDZs are shown for that range type.
Source: NAVFAC Pacific 2013.

Establishment of the LFTRC is essential to maintaining training and readiness of Marine Corps personnel on Guam. The LFTRC would consist of the five separate ranges described above. Each range is designed to meet different training requirements. The usage of each individual range would primarily be dependent upon the number of individuals requiring training on the associated weapon system and the frequency of training required by appropriate training directives. The LFTRC utilization analyzed in this SEIS is up to 39 weeks (273 days) per year, with the remaining 13 weeks of the year unavailable for training due to weather, range maintenance, and holidays. However, each individual range is anticipated to be used less than the entire LFTRC's planned total of 39 weeks. Training at the LFTRC would typically occur during weekdays but periodic weekend use could also occur as needed. Night training is estimated to occur twice per week during the associated qualification periods and would require consecutive firing days.

Table 2.2-4 summarizes the estimated Marine Corps and non-Marine Corps ammunition usage at each range. The estimated annual ammunition usage at the LFTRC under the 2012 Roadmap Adjustments would be approximately 47% less than the amount analyzed in the 2010 Final EIS (an estimated 10,134,750 annual rounds). This reduction would result from the changed composition and reduced numbers of Marine Corps personnel that would be relocated to Guam. Table 2.2-4 also shows the additional estimated annual ammunition usage associated with joint use (non-Marine Corps use) of the LFTRC ranges. The demand for joint use of the ranges would not change as a function of the reduced Marine Corps contingent but would be reduced as a function of the reduced number of weeks of range operation (39 weeks per year compared to 45 weeks per year in the 2010 Final EIS).

The stand-alone HG Range at Andersen South would be operational between 8 a.m. to 4 p.m., with an annual estimated grenade expenditure of 421 grenades.

Table 2.2-4. Estimated Average Annual LFTRC Range Usage

Range	*Weapon*	*Ammunition Type*	*Estimated Ammunition Usage*		
			Day [1]	*Night* [1]	*Total*
Marine Corps					
KD Rifle Range	M16/M4	5.56-mm	1,533,300	322,800	1,856,100
	M249 SAW	5.56-mm	59,200	39,664	98,864
KD Pistol Range	M9	9-mm	324,956	19,328	344,464
Non-standard Small Arms Range	M16/M4	5.56-mm	569,356	403,500	972,856
	M249 SAW	5.56-mm	152,736	34,900	187,636
MRF Range	M16/M4	5.56-mm	304,920	62,820	367,740
	M249 SAW	5.56-mm	59,200	17,760	76,960
MPMG Range	M249 SAW	5.56-mm	377,104	0	377,104
	M40/M110	7.62-mm	13,824	4,104	17,928
	M240	7.62-mm	576,716	141,336	718,052
	M107	0.50-cal	3,520	0	3,520
	M2	0.50-cal	190,756	6,180	196,936
	MK19	40-mm inert	84,480	8,448	92,928
	M-203/ M-32 Grenade Launcher	40-mm inert	24,940	2,580	27,520
Marine Corps Total Estimated Use =			4,275,008	1,063,420	5,338,608
Joint Use (non-Marine Corps) Total Estimated Joint Use =			1,104,466	276,116	1,380,582
GRAND TOTAL (MARINE CORPS AND JOINT USE) =			**5,379,474**	**1,339,536**	**6,719,190**

Legend: SAW = Squad Automatic Weapon.

Notes: [1]"Day" operations would occur between 7:00 a.m. and 7:00 p.m. "Night" operations (estimated to occur two nights per week) would potentially occur between 7:00 p.m. and 10:00 p.m. or 6:00 a.m. and 6:59 a.m. Night firing training requirements need to be met during hours of darkness, dusk until dawn, and this timeframe differs from "acoustic" night (10 p.m. to 7 a.m.) used in noise modeling. Of the 1,063,000 rounds expected during darkness, only 326,000 rounds or 7% of the total number of rounds would occur during "acoustic" night, and no training is planned to occur between the hours of 10:00 p.m. and 6:00 a.m.

UDP personnel would generally not be expected to have access to a privately owned vehicle (POV). Transportation of UDP personnel to and from the LFTRC would be provided using passenger buses. Permanent party officers and Staff Non-Commissioned Officers (SNCOs) would have the option to utilize POVs as transportation to the LFTRC. Lower-ranked personnel would be required to use government-owned vehicles (GOVs) to carry multiple people to and from the LFTRC. Support staff assigned to the ranges may commute via POV or GOV. It is assumed that a proportion of permanent party officers and SNCOs would elect to drive a POV. In addition to transporting personnel, transportation requirements include the movement of equipment and ammunition to the LFTRC via Medium Tactical Vehicle Replacement (MTVR). Each range would also be required to have an emergency response vehicle. The actual number of emergency response vehicles would vary depending on the proximity of individual ranges to each other. Transportation to/from the range is generally not expected to occur during peak travel hours. A summary of the average daily transportation requirements for the LFTRC by vehicle type based on 39 weeks of range utilization per year is provided in Table 2.2-5.

Table 2.2-5. Average Daily Vehicle Usage for the LFTRC

Personnel/Vehicle Type	***# Vehicles***
Range Support Personnel	20 POVs or 7 GOVs
SNCOs and Officer POVs	12
Buses	6
MTVR	6 to 7
Emergency Vehicles	1 to 2

2.2.4 Utilities

The DON updated the utilities analysis studies prepared for the 2010 Final EIS to reflect the reduced Marine Corps population and reduced cantonment/family housing area requirements associated with the 2012 Roadmap Adjustments. The updated studies focused on power, potable water, wastewater, and solid waste disposal, and the DON conducted a new evaluation for information technology/communications (IT/COMM) requirements. The studies factored in the anticipated increase in population and associated utility demand, including direct, indirect, induced, and natural growth. The utilities studies also identified needed utility upgrades, technical solutions for upgrades, and options for implementation to yield viable utilities solutions both on and off-base.

Utilities requirements for the proposed action include:

- On-site utilities projects to support the cantonment, family housing, and live-fire range facilities under each project alternative.
- Off-site utilities projects required to connect the proposed Marine Corps facilities to existing military and civilian utilities infrastructure or other proposed facilities.
- Upgrading or augmenting existing military and civilian utilities infrastructure where necessary and appropriate to support the relocation.

Brief overviews of the proposed utility components that would be the same for any project alternative are provided below. Additional site-specific details are included with the description of each project alternative in Sections 2.4 and 2.5.

- *Power*. Under the SEIS proposed action, the demand for electrical power at the cantonment/family housing area would be reduced relative to the 2010 Final EIS and ROD from an estimated 20 megawatts (MW) to approximately 5.7 MW. Current generation capacity on

Guam would be adequate and no power generation upgrades would be required. Additionally, to comply with Marine Corps sustainability goals (see Section 8.6), a portion of the power demand would be satisfied by power generated from renewable energy sources, to include photovoltaic solar panels on rooftops and approximately 20 acres (8 ha) within the cantonment and/or family housing footprints proposed for ground-mounted photovoltaic panels. Some transmission line upgrades would be required for current transmission infrastructure to function properly and all cantonment/family housing alternatives would require construction of a new on-site substation. The locations and routing for some transmission upgrades would depend upon the cantonment/family housing alternative selected, while some transmission upgrades would be required regardless of the alternative selected. Such site-specific requirements are described in Section 2.4. DON representatives coordinated with GPA to provide a basis for load flow analysis. Based on the load flow analysis performed by GPA (which took into account estimates of future DoD electrical loads, increased electrical demand from the civilian/construction workforce, and the estimated organic civilian growth through the year 2028), the existing 34.5kV transmission lines serving northern Guam would require upgrading. The 34.5kV transmission lines from Harmon Substation to AAFB Main Substation would be upgraded by installing a new underground 34.5kV line. These upgrades would be required for all proposed alternatives.

- *Potable Water*. Potable water demand for the cantonment/family housing area would be reduced from an estimated daily average of 5.82 MGd (22 million liters per day [MLd]) in the 2010 Final EIS to approximately 1.7 MGd (6.4 MLd) for the 2012 Roadmap Adjustments. This 1.7 MGd represents the estimated average daily potable water demand associated with the steady state operations of the relocated Marines with the assumption that all housing units (family housing and bachelor quarters) are fully occupied. The proposed action would require approximately 11 new wells based on estimated daily maximum demand of approximately 2.6 MGd (9.8 MLd), which would be installed at AAFB regardless of the selected cantonment/family housing alternative. Additional potable water may be available due to rehabilitation of some existing wells in northern Guam (which are complete or in progress and not included in the proposed action). The success rate for wells across the NGLA is thought to be on the order of one production well for every two to three test wells. Therefore, for the 11 new wells, approximately 22 to 33 candidate well sites would be selected during the design phase of the potable water supply system. The number of new wells could be reduced depending upon the results of rehabilitation of existing wells and efforts to reduce unaccounted for water in both the Navy and Air Force water systems. The new wells would feed into a new well field storage tank with pumps and treatment system (chlorination and fluoridation) that would in turn feed into the transmission system. Transmission routing lines and new base storage tank locations would vary depending on the cantonment/family housing alternative selected.
- *Wastewater.* Wastewater generation for the cantonment/family housing area would be reduced from an estimated daily average of 2.6 MGd (9.8 MLd) in the 2010 Final EIS to approximately 1.2 MGd (4.5 MLd) for the 2012 Roadmap Adjustments. The issuance of National Pollution Discharge Elimination System (NPDES) permits in 2013 for both the Northern District WWTP and the Agaña WWTP established discharge limits consistent with secondary treatment levels and Guam Water Quality Standards, including those for nutrients. Thus, both plants are currently out of compliance and will continue to be so until upgrades are completed. Regardless of the Marine Corps relocation, both of these existing WWTPs need to be upgraded to meet current NPDES permit requirements for the full design capacity of the plants (12 MGd). Requirements for establishing connections to the existing sewer system infrastructure would depend upon the

potential locations of cantonment/family housing and LFTRC facilities and are described in Sections 2.4 and 2.5, respectively. Until the required WWTP upgrades are operational, additional projected wastewater flows from the proposed action and all other sources would be treated to primary treatment standards. The implications of the NPDES permit compliance situation and potential measures to address any associated impacts are discussed in the *Utility* sections in Chapter 4 for each alternative. In addition, the GWA sewer lines along Routes 3 and 9 from AAFB to the Northern District WWTP are in a state of deterioration and should be relined in the near future. This information was made available in late 2014 from examination of closed circuit television footage taken inside these sewer lines.

- *Solid Waste*. Solid waste generation at the cantonment/family housing area would be reduced from an estimated average of 165,600 pounds/day (75,114 kilograms [kg]/day), as analyzed in the 2010 Final EIS, to approximately 54,250 pounds/day (24,607 kg/day). Guam's Layon landfill has sufficient capacity to support solid waste disposal requirements for the SEIS proposed action. Projects initiated since the 2010 ROD by GovGuam would support implementation of any of the proposed cantonment or LFTRC alternatives and no further improvements would be required. Similar to the 2010 Final EIS, solid waste management would focus on waste reduction, reuse, recycling and minimizing waste generation and promoting landfill diversion during construction and base operations. Beneficial reuse of green waste through composting or other means and construction and demolition debris recovery and processing for reuse are part of the solid waste management plan. Construction and demolition debris would be processed for reuse or disposed in existing disposal facilities in accordance with all regulatory requirements, Executive Orders (EO), and DoD requirements. Each cantonment/family housing alternative would require a solid waste transfer station and recycling center to efficiently manage solid waste.
- *IT/COMM.* The proposed action would require development of IT/COMM infrastructure. The cantonment area would need to be hardwired to the existing Naval computer and telecommunications facilities at Finegayan and to AAFB facilities regardless of the selected alternative. In addition, both secure and non-secure DoD IT/COMM would require inter-base connections between the new Marine Corps cantonment/family housing area and other existing bases, the LFTRC, and training facilities at Andersen South. Because redundant off-island communication paths are necessary, an additional connection from AAFB to the Tata Communications cable termination facility would be required and would need additional easements. The DoD would install underground conduit with manholes/handholes on-base for use by commercial providers to install their own cables. An on-site connection facility for this service would be constructed, if needed. This would provide residential and other facilities of the cantonment/family housing areas with television, internet, and phone service. The most extensive IT/COMM connections would be between the cantonment and LFTRC. The potential routing for the IT/COMM connection would depend on the specific combination of individual cantonment and LFTRC alternatives. The proposed action would also include pulling IT/COMM lines through existing conduit on DoD-controlled lands and easements, including at Apra Harbor and AAFB. Section 2.6 describes potential IT/COMM routes in more detail.

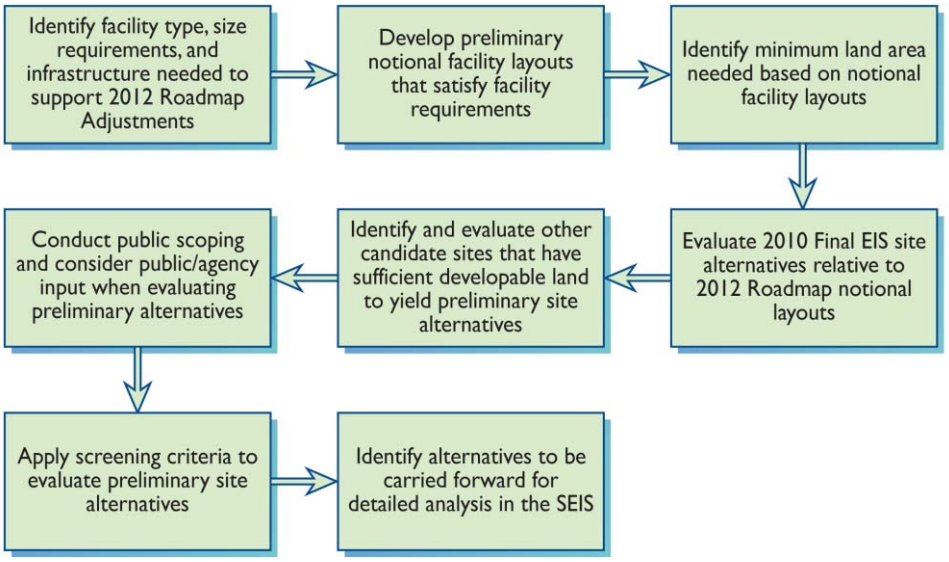
2.2.5 Hazardous Waste and Hazardous Materials

Initial studies indicate that the existing Hazardous Waste Conforming Storage Facility at Apra Harbor is adequately sized to accommodate the proposed action considered in this SEIS. Interim collection and holding sites referred to as Initial Accumulation Points would be required at the point of waste generation

at the proposed cantonment/family housing area, along with a Hazardous Waste Accumulation Site (90-day storage facility) to serve as the central collection facility for the proposed base. Bulk hazardous materials storage would need to be constructed to accommodate the Marine Corps requirements.

2.3 ALTERNATIVES DEVELOPMENT METHODOLOGY

This section summarizes the methodology and criteria used to identify and evaluate action alternatives to implement the 2012 Roadmap Adjustments for the Marine Corps relocation to Guam. The DON applied a methodology that was similar to the one described in the 2010 Final EIS, including the analysis of the individual and aggregate facility land area requirements for the proposed cantonment/family housing areas and the LFTRC, the identification of potential areas on Guam that could accommodate those requirements, and the development and application of appropriate screening criteria to represent the essential operational and mission requirements of the relocating forces. The DON derived initial screening criteria from the "Marine Corps Guam Cantonment Guiding Principles" (hereinafter "Guiding Principles") for the planning and establishment of Marine Corps Base Guam (Headquarters Marine Corps 2012). Additional screening criteria were derived from input provided by the Chief of Staff of the Air Force and Commander, Navy Installations Command (CNIC) as described in Section 2.3.1 below. These criteria were applied to screen out preliminary alternatives that would not satisfy the purpose of and need for the proposed action and should therefore not be considered further in this SEIS. The DON's objective in applying this alternatives analysis process was to systematically identify and evaluate the reasonable action alternatives that would be carried forward in this SEIS. For the purposes of this analysis, an alternative was considered reasonable if it would satisfy the purpose of and need for the proposed action and was practical and feasible from both a technical and economic standpoint. The flowchart below outlines the alternatives development process that was followed for this SEIS.



2.3.1 Marine Corps Guiding Principles, Air Force Boundaries, Commander, Navy Installations Command Land-Use Constraints, and Alternatives Screening Process

On July 5, 2012, Headquarters Marine Corps established the Guiding Principles (Headquarters Marine Corps 2012) shown in Table 2.3-1. The Guiding Principles are the foundation of the requirements for operations, training, quality of life (QOL), and an enduring base for the Marine Corps on Guam. They

reflect lessons learned from planning at existing bases, site-specific planning principles developed during the preparation of the 2010 Final EIS, the Marine Corps' desire to be a good neighbor with the people of Guam, and the Commandant of the Marine Corps' intent to make Guam a "duty station of choice" for Marines and their dependents. The relocation of the Marines to Guam is foremost an operational issue, and directly affects the capability of the III Marine Expeditionary Force, a forward deployed force, to execute its missions in support of the Commander, U.S. Pacific Command.

Table 2.3-1. Marine Corps Guiding Principles

Operational	***Applicable Functions***
Operational facilities lay-down shall be located at a single location to ensure functionality and efficiency in daily operations by providing for and preserving the operational relationships and interdependencies between headquarters, operational units and service providers. Initial estimates indicate this will require approximately 800 acres (324 ha) at a single location. • Exceptions include the ACE at AAFB (North Ramp Area Development Plan), certain waterfront and warehousing operations, munitions storage and disposal, or otherwise as outlined in the Draft Guam Joint Military Master Plan. • Common supply, service, and maintenance functions should be geographically consolidated to the extent practicable in order to limit redundancy and enhance efficiency.	• Main Cantonment • Infrastructure • Training
Training	***Applicable Functions***
Training facilities shall be located to provide maximum utility to the Marine Corps forces on Guam and provide for the individual and unit training outlined in the September 2010 ROD. • Non-live fire training should be located as close as practicable to the main operational cantonment. • Live-fire ranges should be grouped into a contiguous arrangement in order to ensure effective management and control of the ranges, and reduce transportation requirements and associated impacts on the local community.	• Training • Main Cantonment
QOL	***Applicable Functions***
The proximity of family housing and associated facilities and services (e.g., schools, child development centers, parks, and retail) to the main cantonment is a key consideration affecting Marine Corps QOL and force readiness. • Family housing collocated with operational facilities on a contiguous base is strongly preferred. Initial estimates indicate this will take approximately 100 additional acres (40.5 ha) beyond that required for operational facilities. • Locating family housing separate from a contiguous base but in otherwise close proximity to the operational facilities is supportable (although not preferred). Acceptable examples include housing at South Finegayan supporting an operational cantonment at Finegayan or housing at AAFB (with associated QOL and community services) supporting an operational cantonment at Andersen South. Conversely, an arrangement placing the main cantonment at Apra Harbor or Finegayan with housing at Barrigada would be unacceptable. • Housing densities will comply with Unified Facility Criteria (UFC) standards, moderately developed, and rural areas not to exceed 4-6 housing units per acre of land. Hi-rise family housing units are unacceptable. • Family housing shall meet current UFC standards for construction and sizes with adequate supporting infrastructure, public recreational facilities, site amenities and ancillary facilities allotted per the most current UFC, MCO, and DoD guidance. • Bachelor housing must be located on the same installation as the operational facilities it serves, providing a "live where you work" atmosphere. • Unaccompanied and rotational personnel in bachelor housing must have walking access to QOL/community support services, retail, and recreational facilities.	• Main Cantonment • Family Housing

Table 2.3-1. Marine Corps Guiding Principles

Enduring Base	***Applicable Functions***
In order to accommodate Marine Corps units, personnel, and dependents for the next 50 years and minimize potential encroachment on the base and ranges, cantonment size shall encompass sufficient acreage and a flexible base design to accommodate changes and growth, yet also foster a harmonious relationship with the surrounding community. • Facilities must meet established Basic Facility Requirements for their intended purpose per the UFC. • New facilities will meet or exceed current federal, DoD and DON requirements for sustainable design in accordance with the Commandant of the Marine Corps' goal of achieving net-zero energy installations. • Installation proposals will include adequate green/smart growth space and comply with all standoff distances required by current Anti-terrorism and Force Protection measures.	• Main Cantonment • Family Housing • Training • Infrastructure

Source: Headquarters Marine Corps 2012.

In a June 5, 2012 memorandum, the Assistant Secretary of the Air Force for Installations, Environment and Logistics, provided the Chief of Staff of the Air Force "boundaries" for the proposed action on Guam (Department of the Air Force 2012). Listed in priority order, the boundaries are:

- Protect and preserve the Air Force's mission readiness and Operation Plan Execution. This includes airfield operating areas, parking ramps and support facilities as well as areas designated for force beddown in the event of Operation Plan execution.
- Ensure that any alternatives factor in operational suitability and compatibility to existing Air Force training. This includes, but is not limited to, aircraft, airborne, air drop, agile combat support, ranges, and training.
- Analyze and provide Joint Service Mission Support Requirements (family and unaccompanied housing, medical facilities, schools) in a fair and equitable fashion with respect to QOL standards, avoiding the "haves" and "have-nots," and sustaining the QOL for Air Force members and families currently assigned to AAFB. This includes determining which Service is responsible for planning and programming of costs.
- Continue the track record of protection of some of Guam's most sensitive environmental areas.

In a July 30, 2012 memorandum responding to an Assistant Secretary of the Navy (Energy, Installations, and Environment) request for operational impacts of existing and future missions, the CNIC indicated an additional concern that cantonment and family housing alternatives at either AAFB or Apra Harbor may consume a majority of available land for development, increasing the difficulty of accommodating any future mission growth that may require close association with the airfield or harbor assets (DON 2012).

Based on the Guiding Principles, and in consideration of Air Force and CNIC input, the DON developed a two-step screening process for evaluating potential alternatives using initial screening criteria and additional screening criteria. Initial screening criteria represented fundamental requirements that must be met for an alternative to be considered for further analysis. Alternatives that satisfied the initial screening criteria were subsequently evaluated qualitatively in terms of their strengths and weaknesses relative to a defined set of additional screening criteria (e.g., mission impacts or proximity to compatible functions). The DON developed separate sets of screening criteria for the cantonment, family housing, and LFTRC components of the proposed action, as described in the next section.

2.3.2 Cantonment Area Screening Criteria

Initial screening criteria:

- ***Acreage Available Meets or Exceeds Acreage Required.*** A preliminary site alternative must provide sufficient acreage for all cantonment requirements[7] to be located on a single installation, with contiguous land for geographic consolidation of common functions and preservation of the operational relationships and interdependencies between headquarters, operational units, and service providers, including standoff distances and open space required by current Unified Facilities Criteria (UFC) and Anti-Terrorism/Force Protection (AT/FP) directives. In accordance with the Guiding Principle to plan for an Enduring Base, this criterion ensures that the cantonment area will encompass sufficient acreage to support a flexible and sustainable base design and accommodate future changes and growth.
- ***Walkable Access for UDP Units.*** Walkable access for the unaccompanied UDP personnel to QOL services, community support services, and their workplaces is required. For planning purposes, this means that bachelor housing needs to be located on the same installation as the operational facilities and that the distances between the housing and the QOL services, work, and support facilities are achievable by the UDP personnel. While the Guiding Principles do not identify a specific distance for walkability, it was assumed after consultation with the Marine Corps that approximately a 0.5-mile (0.8-kilometer [km]) radius would be acceptable.

Additional screening criteria:

- ***Mission Impacts.*** Operational preference is that development and operation of the Marine Corps cantonment area minimize negative impact to existing and foreseeable future DoD missions.
  - *Strength* - The cantonment would create shared use opportunities or beneficial changes to existing or anticipated future missions that are deemed desirable by existing commands and/or there is no impact to existing or foreseeable future DoD missions.
  - *Weakness* - The cantonment would require changes to existing or anticipated future missions that would compromise the mission as determined by existing commands.
- ***Impacts to DoD Infrastructure.*** Operational preference is that development of the new cantonment minimizes disruption and impacts to existing DoD infrastructure.
  - *Strength* - Cantonment development would not require relocation of existing DoD commands or tenants, modification of occupied DoD facilities, or significant redevelopment of existing DoD infrastructure.
  - *Weakness* - Cantonment development would require significant and disruptive redevelopment of existing DoD facilities and/or infrastructure.

2.3.3 Family Housing Screening Criteria

Initial screening criteria:

- ***Housing Densities Comply with UFC and Marine Corps QOL Standards.*** Housing densities will comply with UFC and Marine Corps QOL standards, moderately developed, and rural areas not to exceed 4 to 6 housing units per acre of land.

[7] Including but not limited to operational and administrative facilities, bachelor housing, QOL, logistics and warehousing, and open space for group training.

- ***Housing Should be Contiguous with Cantonment.*** Family housing that is collocated with operational facilities on a contiguous base is strongly preferred. Locating family housing separate from a contiguous base, but in otherwise close proximity to operational facilities, is supportable.

Additional screening criteria:

- ***Proximity to QOL and Community Support.*** Operational preference is that family housing be located within the same fence line as associated QOL facilities and support services.
  - *Strength* - Family housing would occur within the same fence line as the Marine Corps cantonment or other DoD installation (e.g., AAFB) with full-size QOL and community support facilities such as commissary, exchange, elementary school, medical/dental clinic, and Child Development Center.
  - *Weakness* - Families may have to travel through highly congested roads in order to access QOL and community support facilities.
- ***Mission Impacts.*** Operational preference is that family housing would minimize the negative impact to existing and foreseeable future DoD missions and on-base support.
  - *Strength* - Family housing would create beneficial changes to existing or anticipated DoD missions and on-base support that are deemed desirable by existing commands and tenants and/or there is no impact to existing or foreseeable future DoD missions.
  - *Weakness* - Family housing would require changes to existing or anticipated future missions or on-base support that are deemed undesirable by existing commands and tenants.
- ***Impacts to DoD Infrastructure.*** Operational preference is that development of family housing minimizes disruption and impacts to existing DoD infrastructure.
  - *Strength* - Family housing development would not require relocation of existing DoD commands or tenants, modification of occupied DoD facilities, or significant redevelopment of existing DoD infrastructure.
  - *Weakness* - Family housing development would require significant and disruptive redevelopment of existing DoD facilities and/or infrastructure.

2.3.4 Live-Fire Training Range Complex Screening Criteria

Initial screening criterion:

- ***Sufficient Area (Land, Sea, and Airspace).*** A preliminary site alternative must provide sufficient area on federally owned land, leased land, or controlled air/land/sea space for LFTRC facilities, firing points, impacted areas, and associated SDZs in accordance with Marine Corps training manuals, Basic Facility Requirements, and UFCs.

Additional screening criteria:

- ***Land Acquisition.*** Operational preference is that the LFTRC involve minimal acquisition of non-federal land.
  - *Strength* - All or most of the land is currently owned by the DoD and minimal land acquisition from GovGuam and private landowners would be required.
  - *Weakness* - Would require acquisition of extensive amounts of non-federal land.
- ***Proximity of Ranges to Each Other.*** Operational preference is for all the ranges within the LFTRC, including facilities and associated SDZs, to be grouped as close together as possible to maximize training efficiencies, and to ensure effective management and control of the ranges. This also reduces the overall footprint for the LFTRC.

  - *Strength* - All live-fire training ranges could be constructed on a contiguous parcel in a single complex.
  - *Weakness* - Live-fire training ranges would be divided in a way that is operationally undesirable to the Marine Corps.
- ***Proximity of Ranges to Cantonment.*** Operational preference is that the LFTRC be located close to the cantonment. Training facilities should be located as close as practical to the cantonment to reduce transportation requirements and associated impacts on the local community.
  - *Strength* - The LFTRC would be located within the same fence line as the cantonment.
  - *Weakness* - The LFTRC would not be located within the same general region (e.g., northern or southern Guam) as the cantonment, or would require travel through heavily populated areas or highly congested roads.
- ***Mission Impacts.*** Operational preference is to minimize the LFTRC's negative impact to existing or foreseeable future DoD missions on Guam.
  - *Strength* - The LFTRC would create shared use opportunities or beneficial changes to existing or anticipated future missions that are deemed desirable by existing commands and/or there is no impact to existing or foreseeable future DoD missions.
  - *Weakness* - The LFTRC would require changes to existing or anticipated future missions that would compromise the mission as determined by existing commands.
- ***Impacts to DoD Infrastructure.*** Development of the LFTRC should minimize disruption of existing DoD infrastructure.
  - *Strength* - LFTRC development would not require relocation of existing DoD commands or tenants, modification of occupied DoD facilities, or significant redevelopment of existing DoD infrastructure.
  - *Weakness* - LFTRC development would require significant and disruptive redevelopment of existing DoD facilities and/or infrastructure.

2.4 CANTONMENT AND HOUSING ALTERNATIVES

2.4.1 Preliminary Alternatives for Cantonment and Family Housing

As described in Section 2.3, the DON initiated the alternatives analysis process by identifying minimum individual and aggregate facility land area requirements based on notional preliminary layouts of cantonment/family housing areas and associated infrastructure. The DON estimated the appropriate facility size and type requirements based on the planned size of the base population, the UFC, and the completion of Basic Facility Requirements. The notional land area requirements assumed a 100% developable area and did not account for any site-specific conditions. Table 2.4-1 provides the resulting minimum land area requirements for two cantonment/family housing scenarios as derived for the preliminary evaluation. A generic stand-alone location (i.e., not on an existing military installation on Guam) was estimated to require between 653 and 784 acres (264 and 317 ha). Development of the Marine Corps cantonment/family housing functions at AAFB was estimated to require a minimum land area between 787 and 1,076 acres (318 and 435 ha). These preliminary notional acreage estimates included building footprints, parking and other pavements, required AT/FP setbacks, additional allowances to accommodate planning factors for roadways, drainage, future growth, and a contingency for unknown factors. These minimum acreage requirements are considerably smaller than the approximately 2,580 acres (1,044 ha) that comprised the area of the cantonment/family housing preferred alternative considered in the 2010 Final EIS. The land area of each of the five actual cantonment/family housing alternatives carried forward for analysis in this SEIS (described in Section 2.4.5) were larger than the

initial notional land area requirements, as more detailed site-specific planning considered reserved areas (e.g., to preserve existing DoD missions), undevelopable portions of each site, and other constraints on developable area. All four of the resulting site alternatives remained considerably smaller than the preferred alternative in the 2010 Final EIS (the No-Action Alternative in this SEIS).

Table 2.4-1. Preliminary Estimates of the Minimum Land Area Required for Notional Cantonment and Family Housing Areas[1]

Function	*Land Area Requirement[2] (Stand-Alone Base)*		*Land Area Requirement[2] (at AAFB)*	
	Low Estimate (acre / ha)	*High Estimate (acre / ha)*	*Low Estimate (acre / ha)*	*High Estimate (acre / ha)*
Cantonment [2,3]	505 / 204	557 / 225	462 / 187	530 / 214
Family Housing [2,4]	148 / 60	227 / 92	325 / 131	546 / 221
Total[5]	**653 / 264**	**784 / 317**	**787 / 318**	**1,076 / 435**
Average	718 / 291		932 / 377	

Notes: [1]Requirements as of August 24, 2012.
[2]Low and high estimates are due to variation in planning factors applied to the land requirement analysis.
[3]Some existing facilities and/or expansion required to accommodate Marine Corps requirements are outside of areas being considered.
[4]At AAFB, requirements include replacement of 912 existing family housing units.
[5]Total acreage assumes 100% developable land area.

After calculating the land area requirements for the proposed cantonment and family housing as a function of the reduced scope of the military relocation under the 2012 Roadmap Adjustments, the DON revisited the set of preliminary site alternatives that were considered in the 2010 Final EIS. In that EIS, the DON had initially evaluated a variety of DoD properties before narrowing the alternatives to four variations of the same location (Finegayan) that were analyzed in detail (Volume 2, Chapter 2: Description of Proposed Action and Alternatives, Section 2.2.3: Alternatives Carried Forward for Analysis: Main Cantonment Area, pages 2-31 to 2-40). The alternatives originally considered in the 2010 Final EIS included DoD properties at Finegayan, South Finegayan, Andersen South, and both Naval Base Guam, Barrigada and AAFB, Air Force Barrigada (hereinafter referred to collectively as "Barrigada").

Similar to the approach taken in the 2010 Final EIS, the identification of preliminary alternatives for this SEIS also focused on utilizing existing DoD properties with sufficient developable land area to accommodate the projected size of the cantonment/family housing area requirement. Figure 2.4-1 shows the DoD properties on Guam that are large enough to be considered cantonment/family housing preliminary alternatives and how much developable land is available at each property. Although large enough to accommodate the reduced-size cantonment requirements of the 2012 Roadmap Adjustments, the DON removed Andersen South from the list of potential SEIS preliminary alternatives because it had been approved for non-live fire training functions in the 2010 ROD, and cantonment/family housing functions would not be compatible with the training mission and operations to be implemented in that area. Similarly, the nature of the existing missions and land uses at NWF (aircraft operations) and NAVMAG area (munitions storage) precluded their consideration as potential cantonment/family housing alternatives. These locations are shown on Figure 2.4-1 as being incompatible with the prospective cantonment/family housing land uses. In addition, based on a preliminary feasibility evaluation, the DON determined that Apra Harbor and AAFB warranted further evaluation as potential cantonment/family housing alternatives because both bases initially appeared to have the available acreage to support a cantonment and family housing.

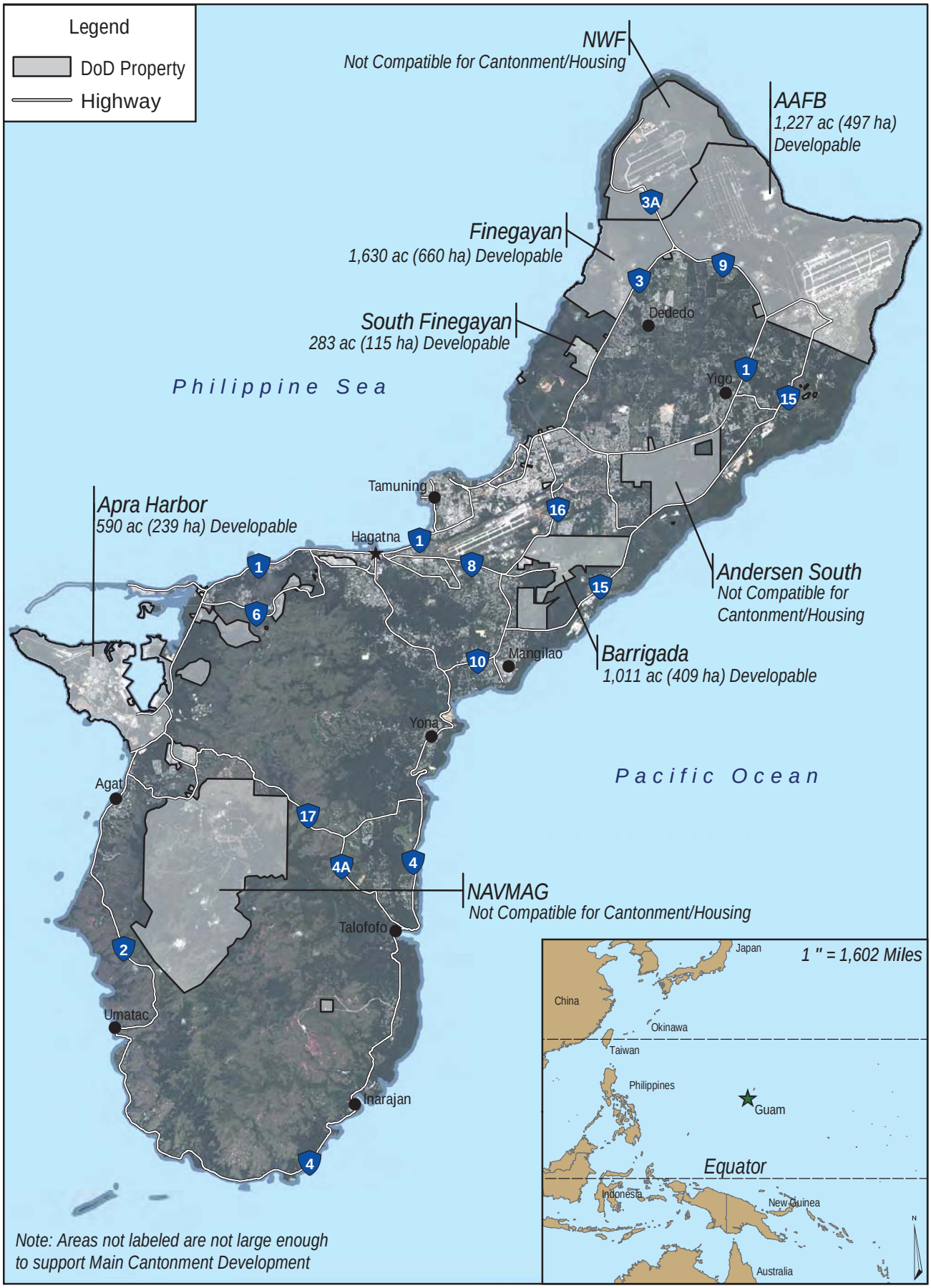


Figure 2.4-1
Guam Overview Map with DoD Developable Lands

2.4.2 Post-scoping Evaluation of Preliminary Alternatives for Cantonment/Family Housing

The DON applied the screening criteria described above to evaluate an initial set of four preliminary site alternatives for cantonment (Finegayan, AAFB, Barrigada, and Apra Harbor) and a set of five preliminary site alternatives for family housing and associated facilities (Finegayan, South Finegayan, AAFB, Barrigada, and Apra Harbor). After considering the Guiding Principles, the DON consolidated these preliminary alternatives into five combined cantonment/family housing preliminary alternatives for purposes of public scoping. The five preliminary alternatives for cantonment/family housing were:

- Finegayan Cantonment/Family Housing
- Finegayan Cantonment/South Finegayan Family Housing
- AAFB Cantonment/Family Housing
- Barrigada Cantonment/Family Housing
- Apra Harbor Cantonment/Family Housing

Despite some partial commonality and overlap with the site layouts analyzed in the 2010 Final EIS, the first two preliminary site alternatives listed above (involving Finegayan and South Finegayan) differ substantially from those previous alternatives. The preliminary alternatives above would require a substantially smaller development footprint than was analyzed in the 2010 Final EIS, and would not require the use of the adjacent former FAA parcel or Harmon Annex property. The following subsections evaluate each of these preliminary site alternatives relative to the screening criteria defined in Section 2.3. After each screening criteria is applied below, a determination is made about whether or not each criterion is met (for Initial Screening Criteria) or if the conditions represent a strength or a weakness (for Additional Screening Criteria), as defined in Section 2.3.

2.4.2.1 Finegayan Cantonment/Family Housing

Initial Screening Criteria (Cantonment):

Acreage Available Meets or Exceeds Acreage Required. As shown in Figure 2.4-1, Finegayan has approximately 1,630 acres (660 ha) of potentially available area for Marine Corps development, which would include portions of the Guam NWR Overlay lands (Overlay Refuge), which are managed by the DoD/Navy under a Cooperative Agreement with the USFWS. Finegayan has limited existing support facilities/infrastructure, so the stand-alone requirement (average of 531 acres [215 ha]) for a cantonment area) was applied (see Table 2.4-1). *(Meets Criterion)*

Walkable Access for UDP Units. Based on conceptual land use plans prepared for the Finegayan cantonment area, walkability was considered achievable. A standard six-story Bachelor Enlisted Quarters (BEQ) design concept developed to support a high density of development for the unaccompanied personnel housing would facilitate a pedestrian-friendly balance between living, working, and recreation areas. QOL and community support facilities could be located within walking distance (up to a 0.5-mile [0.8-km] radius). *(Meets Criterion)*

Additional Screening Criteria (Cantonment):

Mission Impacts. Land has been set aside to provide for the protection of the existing Finegayan intelligence and communications mission, as well as projected expansion requirements. Vertical construction can be controlled so as not to encroach on the receiver antenna look-angle restrictions and existing buried IT/COMM lines can be left undisturbed during and after construction. *(Strength)*

Impacts to DoD Infrastructure. Construction can be planned and executed to minimize disruption to existing infrastructure. *(Strength)*

Cantonment Conclusion: The Finegayan site is a feasible alternative for the Marine Corps cantonment because it has adequate land area and can be developed to provide walkable access and appropriate protection of the ongoing military mission and DoD infrastructure.

Initial Screening Criteria (Family Housing):

Housing Complies with UFC Standards: The projected family housing requirement (see Table 2.4-1) for UFC standard density requirements ranges between 148 to 227 acres (60 to 92 ha) for a stand-alone housing complex. As described above for cantonment, Finegayan has approximately 1,630 acres (660 ha) of developable area, sufficient to accommodate both cantonment and family housing within the same installation. *(Meets Criterion)*

Housing Should be Contiguous with Cantonment: Finegayan has sufficient developable land available to accommodate both the cantonment and family housing. *(Meets Criterion)*

Additional Screening Criteria (Family Housing):

Proximity to QOL and Community Support: Finegayan has sufficient developable land available to design the base such that family housing and QOL/community support facilities would be in close proximity. *(Strength)*

Mission Impacts: The development of Marine Corps family housing at Finegayan would represent a beneficial upgrade to existing housing inventory. The existing Finegayan intelligence and communications missions would be preserved, as well as adjacent land for potential future expansion. *(Strength)*

Impacts to DoD Infrastructure: Construction can be planned and executed to minimize disruption to existing infrastructure. *(Strength)*

Family Housing Conclusion: Finegayan is a feasible alternative for family housing and associated QOL/community support functions if Finegayan is selected for the cantonment.

2.4.2.2 Finegayan Cantonment/South Finegayan Housing

As discussed above, the Finegayan site is a feasible alternative for the Marine Corps cantonment because it has adequate land area and can be developed with appropriate protection of the ongoing military mission and DoD infrastructure *(Meets Criteria)*.

The following describes the screening evaluation of the South Finegayan site as a preliminary alternative for the family housing component of the proposed action.

Initial Screening Criteria (Family Housing):

Housing Complies with UFC Standards: As shown on Figure 2.4-1, South Finegayan has approximately 283 acres (115 ha) of developable area, sufficient to accommodate the family housing complex. *(Meets Criterion)*

Housing Should be Contiguous with Cantonment: South Finegayan is close to Finegayan and formerly served as a family housing site for the communications personnel at Finegayan when its base population was much larger. Although not contiguous to Finegayan, it is within approximately 1 road mile (1.6 km) of the southern Finegayan property boundary. South Finegayan would satisfy this criterion because it is proximate to a potential cantonment area at Finegayan and would allow for relatively easy access to the cantonment area and community support facilities. *(Meets Criterion)*

Additional Screening Criteria (Family Housing):

Proximity to QOL and Community Support: South Finegayan has sufficient developable land available to design the housing complex such that family housing and QOL/community support facilities would be in close proximity. *(Strength)*

Mission Impacts: There is no existing DoD mission at South Finegayan as most of the existing 233 units of old housing on the site are not suitable for use. *(Strength)*

Impacts to DoD Infrastructure: No disruption to existing infrastructure is expected from the development of a family housing complex at South Finegayan. *(Strength)*

Family Housing Conclusion: South Finegayan is a feasible alternative for family housing and associated QOL/community support functions if Finegayan is selected for the cantonment.

2.4.2.3 Andersen Air Force Base Cantonment/Family Housing

Initial Screening Criteria (Cantonment):

Acreage Available Meets or Exceeds Acreage Required. As shown in Figure 2.4-1, AAFB has approximately 1,227 acres (497 ha) of potentially available area for Marine Corps development. Because AAFB has well-developed base support facilities, the estimated acreage requirement for development of the Marine Corps cantonment (see Table 2.4-1) would be from 462 to 530 acres (187 to 214 ha). *(Meets Criterion)*

Walkable Access for UDP Units. Development of the cantonment would occur on the north side of the installation, in proximity to the planned ACE complex near the North Ramp. Some QOL and community support facilities would be required to support the unaccompanied personnel assigned to the UDP units. A standard six-story BEQ design concept that supports a high density of development for the unaccompanied personnel housing would facilitate a pedestrian-friendly development among living, working, and recreation areas. *(Meets Criterion)*

Additional Screening Criteria (Cantonment):

Mission Impacts. The feasibility analysis determined that the cantonment could be sited so that no existing Air Force missions would need to be relocated. However, munitions are currently transported several times per week to the airfield along a primary route north and east of the proposed cantonment area, which has the potential to cause the evacuation of up to 100% of the cantonment if a munitions transport incident were to occur during transport somewhere along that route. An alternative route has been recommended to AAFB; however, this route would also require significant evacuation of the cantonment if a munitions transport incident were to occur. Additionally, siting the cantonment at AAFB would limit future expansion potential of the Air Force operational mission. *(Weakness)*

Impacts to DoD Infrastructure. A major expansion requiring disruption of the utilities systems would be required to support the additional facilities and functions. (*Weakness)*

Cantonment Conclusion: Based on the initial screening criteria, AAFB is a feasible alternative for the Marine Corps cantonment as it has adequate land area and could be developed to provide walkable access for UDP units. However, the site has weaknesses in additional screening criteria, particularly related to the need for deconfliction of munitions transport issues and limitations on Air Force mission expansion potential. The DON determined that this preliminary alternative would be carried forward for analysis in this SEIS despite these weaknesses.

Initial Screening Criteria (Family Housing):

Housing Complies with UFC Standards: The projected family housing requirement (see Table 2.4-1) must allow for UFC standard density requirements ranges between 325 to 546 acres (131 to 221 ha). As described above for cantonment, AAFB has approximately 1,227 acres (497 ha) of developable area, sufficient to accommodate both cantonment and family housing within the same installation. *(Meets Criterion)*

Housing Should be Contiguous with Cantonment: AAFB has sufficient developable land available to accommodate both the cantonment and family housing, although the housing would be located approximately 2 road miles (3.2 km) from the cantonment area. This criterion refers to housing and cantonment being contiguous in the sense that they should be located within the same installation, which would be the case at AAFB. Though not ideal, the Marine Corps considers the housing area under this preliminary alternative to be in sufficiently close proximity to the operational facilities to be in compliance with this Guiding Principle requirement. *(Meets Criterion)*

Additional Screening Criteria (Family Housing):

Proximity to QOL and Community Support: AAFB has sufficient developable land to plan the Marine Corps facilities for close proximity between family housing and QOL/community support facilities. *(Strength)*

Mission Impacts: The Air Force's mission readiness and Operation Plan execution capability must be protected and preserved. Based on a preliminary analysis, no relocation of Air Force mission functions would be required to accommodate the Marine Corps family housing development. *(Strength)*

Impacts to DoD Infrastructure: If AAFB were selected as the family housing site, existing family housing would require replacement, the utilities systems would require modifications to accommodate revised road layout, and current communication infrastructure may require relocation. *(Weakness)*

Family Housing Conclusion: Based on the criteria above, AAFB is a feasible alternative for development of Marine Corps family housing and associated QOL/community support functions.

2.4.2.4 Barrigada Cantonment/Family Housing

Initial Screening Criteria (Cantonment):

Acreage Available Meets or Exceeds Acreage Required. As shown in Figure 2.4-1, Barrigada has approximately 1,011 acres (409 ha) of potentially developable area, including the closed Nimitz Golf Course. Approximately 531 acres (215 ha) would be required for a stand-alone cantonment location. *(Meets Criterion)*

Walkable Access for UDP Units. Based on conceptual land use plans prepared for the Barrigada cantonment area, walkability was considered partially achievable. A standard six-story BEQ design concept developed to support a high density of development for the unaccompanied personnel housing would facilitate a pedestrian-friendly development between living, working, and recreation areas. QOL and community support facilities could also be located within walking distance (up to a 0.5-mile [0.8-km] radius). *(Meets Criterion)*

Additional Screening Criteria (Cantonment):

Mission Impacts. The DON identified some planning considerations for facility development in the vicinity of the Navy Antenna Field that occupies the eastern portion of the Barrigada site and the Next-Generation Radar (NEXRAD) weather facility in the southern portion of the site. A Reserved Area encompasses the Navy Antenna Field, which is intended not only to protect the existing telecommunications mission but to provide for future growth of the Navy's mission, as land for potential expansion is located in the northeastern and northwestern portions of the Reserved Area. There is also a no-build area on the southern slope of Mt. Barrigada to protect the antenna look angle. The transmitters generate an electromagnetic radiation (EMR) arc, but a 2009 Space and Naval Warfare Systems Command (SPAWAR) study concluded that for the area potentially available for development at Barrigada, no hazards of EMR to personnel were predicted, provided that the no-build area was avoided and additional fencing of the antennas and antenna field was constructed to prevent unauthorized access (Commanding Officer, SPAWAR Pacific 2009).

NEXRAD is a weather surveillance radar operated by the National Weather Service for detecting precipitation and weather patterns. Blockage of the radar beam from buildings or towers can adversely affect the quality of the radar data and weather detection capability. To avoid interference with the radar beam, a 100-feet (30-m) height limit for all structures would be maintained. Additionally, in accordance with the recommendations of the 2009 SPAWAR study, no activity would occur within a 100-foot (30-m) radius of the NEXRAD tower and all structures and construction activity within a 600-foot (183-m) radius around the tower would be limited to a height of 68.5 feet (20.9 m) to avoid potential health impacts from proximity to the NEXRAD. Construction of the cantonment area at Barrigada would follow all such construction guidelines and avoid these designated zones to preclude negative mission impacts. *(Strength)*

Impacts to DoD Infrastructure. Development of the cantonment area at Barrigada would not require relocation of or otherwise impact existing DoD infrastructure. *(Strength)*

Cantonment Conclusion: Barrigada is a feasible alternative for the Marine Corps cantonment area. Planning considerations associated with the existing transmitters and the NEXRAD weather facility would be addressed in the detailed planning analysis.

Initial Screening Criteria (Family Housing):

Housing Complies with UFC Standards: As shown on Figure 2.4-1, Barrigada has approximately 1,011 acres (409 ha) of potentially developable area, including the closed Nimitz Golf Course, which would be sufficient to accommodate the family housing complex. *(Meets Criterion)*

Housing Should be Contiguous with Cantonment: As described above for cantonment, Barrigada has approximately 1,011 acres (409 ha) of potentially developable area, including the closed Nimitz Golf Course, which would be sufficient to accommodate both cantonment and family housing within the same installation. Although the family housing area would not be adjacent to the cantonment, it would be within approximately 1 road mile (1.6 km) of the cantonment area. This criterion would be met because there would be ease of access to the cantonment area and community support facilities. *(Meets Criterion)*

Additional Screening Criteria (Family Housing):

Proximity to QOL and Community Support: Barrigada has sufficient developable land available to design the base such that family housing would be in close proximity to these facilities. *(Strength)*

Mission Impacts: Construction of housing would not impact the NEXRAD weather facility on the Barrigada property. *(Strength)*

Impacts to DoD Infrastructure: Family housing development at Barrigada would not require any relocation of or otherwise impact existing DoD infrastructure. *(Strength)*

Family Housing Conclusion: Barrigada is a feasible alternative for development of family housing and associated QOL/community support functions if Barrigada is selected for the cantonment.

2.4.2.5 Apra Harbor Cantonment/Family Housing

Initial Screening Criteria (Cantonment):

Acreage Available Meets or Exceeds Acreage Required. In a preliminary evaluation, the DON identified approximately 590 acres (239 ha) of land potentially available for Marine Corps development at Apra Harbor (see Figure 2.4-1), but it is distributed over several non-contiguous parcels (i.e., Apra Harbor main base, Polaris Point, Camp Covington, and Apra Heights) as shown in Figure 2.4-2.

The DON had also estimated the total land requirement for Marine Corps cantonment and family housing at Apra Harbor to be between 557 to 696 acres (225 to 282 ha). Based on this information, the DON determined that Apra Harbor required more detailed planning analysis to confirm the feasibility of the base for development of Marine Corps cantonment/family housing. Consequently, in the NOI published for this SEIS in October 2012, the DON identified Apra Harbor as one of five preliminary alternatives for potential establishment of the Marine Corps cantonment/family housing functions in support of the 2012 Roadmap Adjustments. The DON also presented the Apra Harbor preliminary alternative, along with the other cantonment/family housing and LFTRC preliminary alternatives, for public review and comment during the SEIS scoping period that ended on December 10, 2012.

Following public scoping, a more detailed planning investigation was conducted for the Apra Harbor preliminary alternative. This more intensive planning analysis revealed substantial constraints in developing a workable cantonment/family housing layout at Apra Harbor, including an insufficient number of developable acres available and the need to displace and relocate several existing missions and functions to other federal lands on Guam. The investigation also identified limitations on the use of specific available parcels dispersed among existing Apra Harbor functions, protected wetlands, and other development constraints. The alternative could also not be designed to meet Marine Corps Guiding Principles (see Table 2.3-1). In an effort to try to make additional land available for development, the DON had to conceptually incorporate multi-level parking structures into the site layout; however, this proved unworkable due to the size and weight of military vehicles. The garages would also be considerably more expensive to construct.

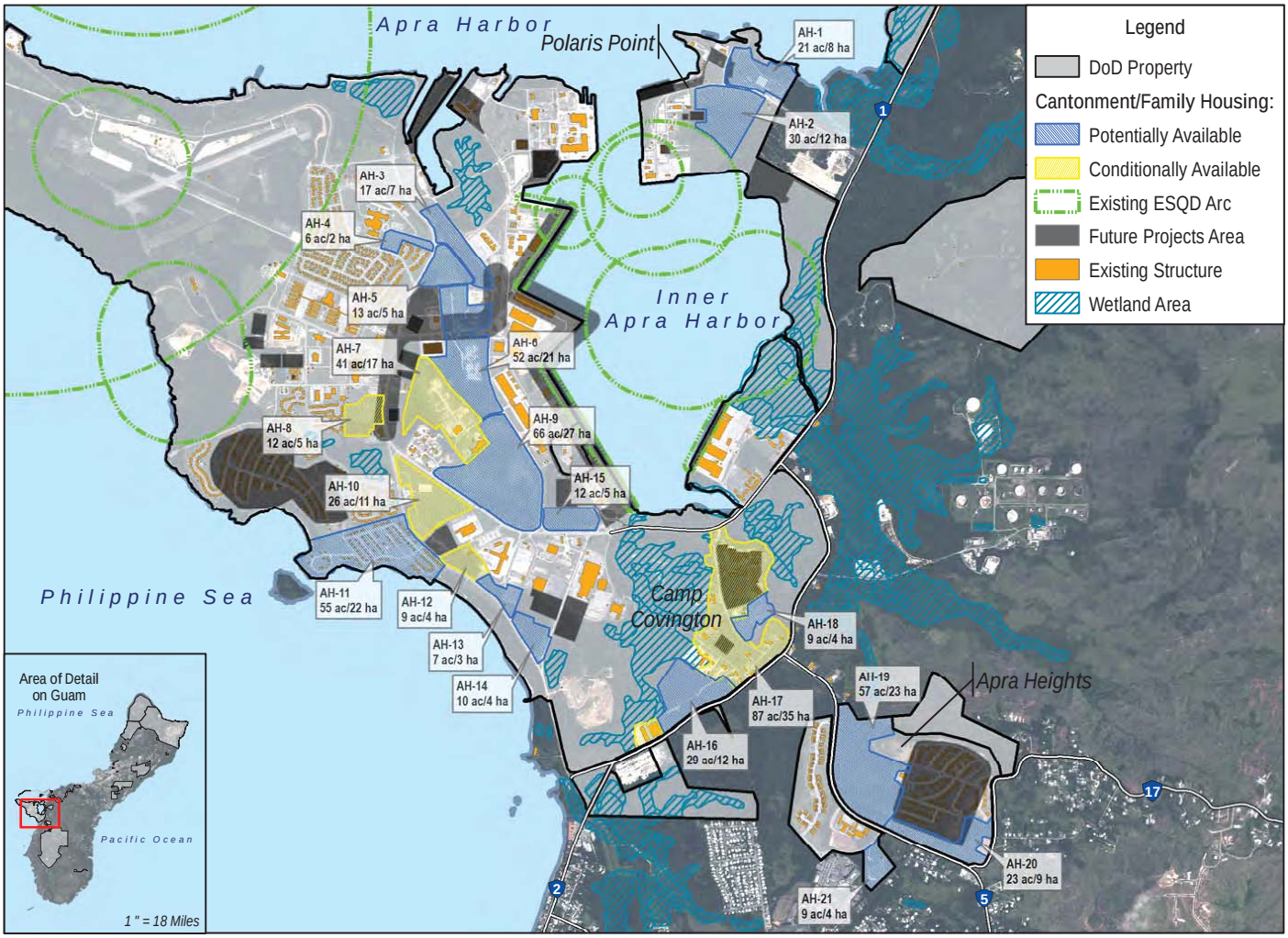


Figure 2.4-2
Apra Harbor Preliminary Cantonment/Family Housing Alternative Eliminated from Further Consideration

Source: NAVFAC Pacific 2013

The DON ultimately identified a total of 672 acres (272 ha) of developable land for this preliminary alternative (421 acres [170 ha] for cantonment and 251 acres [102 ha] for family housing) after integrating land use functional relationships with infrastructure (e.g., grading, drainage, low-impact development, utility corridors), topography/slope, wetlands, Kilo Wharf explosive safety zones, and other factors. Although more land was identified (672 acres [272 ha]) than was originally thought available (590 acres [239 ha]), the land available for potential development was scattered over the entire base and was dependent on other missions/functions being relocated to other locations.

Based on the additional information from the detailed planning analysis, the DON concluded that the dispersed, segmented nature of the available land on Apra Harbor did not allow for layout of the facilities in a manner that would provide functionality and efficiency of operations, and would not preserve operational relationships and interdependencies, thereby not meeting Marine Corps guidelines. For example, the developable area at Apra Harbor is bisected by Marine Corps Drive (a major transportation artery through the base) and an adjacent sewage treatment plant. As a result, key supply, service, and maintenance functions could not be appropriately consolidated geographically. The multi-story parking structures in some cases had to be located up to 0.5-mile (0.8-km) away by road from operational workplaces, and included two structures designated for combined government (tactical) vehicles and personally-owned vehicles. The DON identified security concerns, operational challenges, and inefficiencies associated with such a layout, and concluded that the use of multi-level parking structures with associated walking distances to workplaces would not satisfy the operational guiding principle for functionality and efficiency in daily operations. *(Does Not Meet Criterion)*

Walkable Access for UDP Units. Given the limitations of the developable space at Apra Harbor, bachelor housing could not be situated to provide walkable access to community support facilities, so this preliminary alternative would not comply with the QOL guiding principle. *(Does Not Meet Criterion)*

Cantonment Conclusion: Based on the results of detailed planning efforts, the DON determined that the development of a cantonment area at Apra Harbor is not a reasonable alternative because it does not meet Marine Corps Guiding Principles and associated initial screening criteria (see Section 2.3). Accordingly, this alternative was not evaluated further. The Apra Harbor alternative was eliminated from further consideration and is not carried forward for analysis in this SEIS.

2.4.3 Summary of Alternatives Screening Evaluation for Cantonment/Family Housing

Table 2.4-2 summarizes the results of the screening evaluation for each of the cantonment/family housing preliminary alternatives discussed in Section 2.4.2. As shown in the table, and as discussed in Section 2.4.2.5, the Apra Harbor preliminary alternative did not satisfy the screening criteria and was therefore eliminated from further analysis in this SEIS.

Table 2.4-2. Results of Preliminary Alternative Screening Evaluation for Cantonment/Family Housing

	Finegayan Cantonment/ Housing	***Finegayan Cantonment/ South Finegayan Housing***	***AAFB Cantonment/ Housing***	***Barrigada Cantonment/ Housing***	***Apra Harbor Cantonment/ Housing***
Initial Screening Criteria: Cantonment					
Acreage Available	Meets Criterion	Meets Criterion	Meets Criterion	Meets Criterion	Does not Meet Criterion
Walkable Access	Meets Criterion	Meets Criterion	Meets Criterion	Meets Criterion	Does not Meet Criterion
Additional Screening Criteria: Cantonment					
Mission Impacts	Strength	Strength	Weakness	Strength	Not Evaluated
Infrastructure Impacts	Strength	Strength	Weakness	Strength	Not Evaluated
Conclusion	***Carried Forward***	***Carried Forward***	***Carried Forward***	***Carried Forward***	***Not Carried Forward***
Initial Screening Criteria: Family Housing					
Housing Complies	Meets Criterion	Meets Criterion	Meets Criterion	Meets Criterion	Not Evaluated
Housing Contiguous	Meets Criterion	Meets Criterion	Meets Criterion	Meets Criterion	Not Evaluated
Additional Screening Criteria: Family Housing					
Proximity to QOL	Strength	Strength	Strength	Strength	Not Evaluated
Mission Impacts	Strength	Strength	Strength	Strength	Not Evaluated
Infrastructure Impacts	Strength	Strength	Weakness	Strength	Not Evaluated
Conclusion	***Carried Forward***	***Carried Forward***	***Carried Forward***	***Carried Forward***	***Not Carried Forward***
Overall Conclusion	***Carried Forward***	***Carried Forward***	***Carried Forward***	***Carried Forward***	***Not Carried Forward***

2.4.4 Alternatives Carried Forward for Analysis: Cantonment/Family Housing

The alternatives screening process and evaluation determined that four of the five preliminary cantonment/family housing alternatives were sufficiently aligned with the Marine Corps Guiding Principles and additional screening criteria to be carried forward for analysis of impacts in the Draft SEIS. These alternatives are identified as Alternatives A, B, C, and D and are described in detail below. In addition, as a result of the DON's continued analysis of environmental, cost, and other issues, as well as feedback from the public and local and federal agencies during the Draft SEIS public comment period, a fifth reasonable alternative (Alternative E) was added to the analysis during preparation of this Final SEIS. The Draft SEIS (page 2-21) noted that the range of reasonable cantonment/family housing alternative combinations would continue to be reviewed by DON during the Draft SEIS public comment period, and that adjustments to such combinations would be considered and addressed in accordance with NEPA requirements.

Figure 2.4-3 shows the locations of all five cantonment/family housing alternatives carried forward for analysis in this Final SEIS:

- Finegayan Cantonment/Family Housing (Alternative A)
- Finegayan Cantonment/South Finegayan Family Housing (Alternative B)
- AAFB Cantonment/Family Housing (Alternative C)
- Barrigada Cantonment/Family Housing (Alternative D)
- Finegayan Cantonment/AAFB Family Housing (Alternative E)

Alternative E represents a combination of the cantonment area portion of Alternatives A and B at Finegayan and the family housing portion of Alternative C at AAFB. Because Alternative E is a combination of both Alternative A (or B) and C, it also satisfies the screening criteria described above. Although, as with Alternative B, the cantonment area and the family housing area under Alternative E are not contiguous, the DON determined that Alternative E would satisfy the contiguity criterion and the proximity to QOL and community support criterion because access between the two areas would be relatively convenient via Route 9 and the existing QOL/community support functions at AAFB would be in close proximity to family housing.

As described in Section 2.1, a No-Action Alternative was also carried forward for analysis in this SEIS, although such an alternative would not meet the purpose of and need for the proposed action and would not be consistent with the new force posture adopted by the DoD in the 2012 Roadmap Adjustments.

Under the five identified action alternatives, each cantonment area would consist of six functional areas: Command Core, Unit Operations, Base Operations, BEQ and Bachelor Officer Quarters (BOQ), Community Support, and Training. Family housing areas would include three types of family housing units (single-family residences, duplex residences, and four-plex residences), a community center, elementary school, child development center(s), temporary lodging facility, youth center, and a base exchange. The DON will consider establishing a shuttle bus system to reduce traffic and improve circulation if deemed necessary. The shuttle system would transport Marine Corps personnel around the cantonment area and provide service to on-base destinations. On-base shuttle service could also be coordinated with the Guam Regional Transit Authority (GRTA) bus system to provide service to popular off-base destinations. Any grading and other earthwork required during facility construction at any of the alternative sites would be implemented to balance cut and fill on-site to the extent possible. If off-site fill material were needed, it would be obtained from a permitted source.

As described in the following subsections, each of the alternatives includes site-specific design characteristics associated with a notional facility layout (which may be subject to change as the planning and design process continues), a construction footprint or potential area of impact (which would not change regardless of ongoing site planning modifications), and both on-site and off-site utility infrastructure requirements. Common to each alternative and regardless of location, off-site development and extension of utility infrastructure, new water wells, and either facility expansion or conversion with new construction at existing DoD school facilities would be required and are presented in Section 2.4.4.6 and shown in Figure 2.4-14. These common off-site improvements are not presented within each alternative for clarity and reduced repetition.

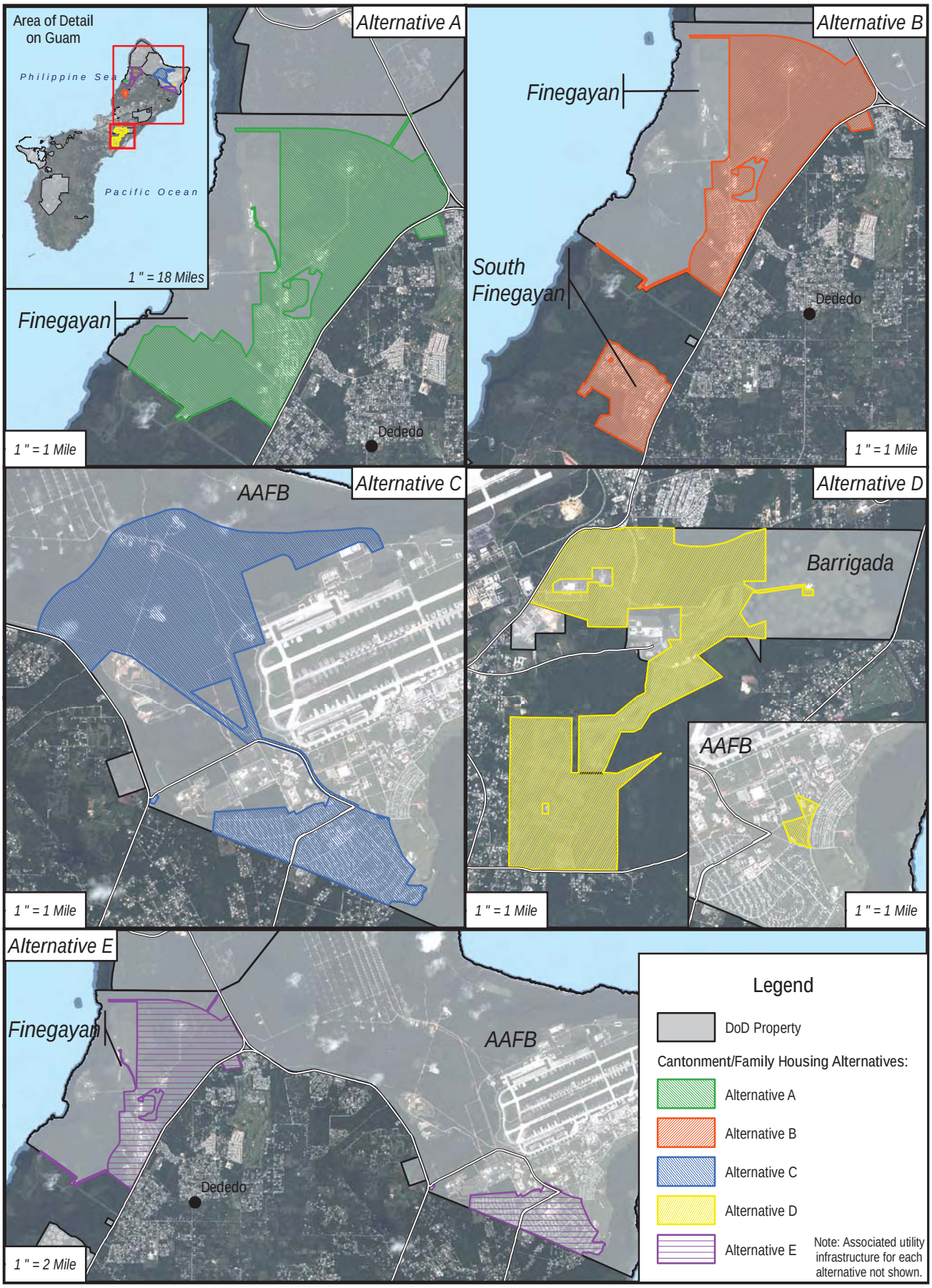


Figure 2.4-3
Cantonment/Family Housing Alternatives
Carried Forward for Analysis

Source: NAVFAC Pacific 2013

2.4.4.1 Finegayan Cantonment/Family Housing - Alternative A

The Finegayan cantonment/family housing alternative (Alternative A) is completely contained on existing federally owned land. This alternative is bounded on the north by NWF, on the east by Route 3, and on the west by a cliffline (within federal property), the Haputo Ecological Reserve, and the Philippine Sea. The site is also bounded to the east by limited residential development and to the south by the Dos Amantes planned area, also known as the former Harmon Village (non-federal property). Although DoD property descends to the coastline, the cantonment area would be situated on the upper area of Finegayan and would not encroach on the cliffline leading to the ocean or the adjacent ecological reserve.

Alternative A is shown in Figure 2.4-4. This alternative would comprise approximately 1,495 acres (605 ha) within one contiguous parcel of land, although the family housing area would be separated from the cantonment core by approximately 1.5 miles (2.4 km). The Finegayan housing density would comply with the Marine Corps density range.

Finegayan would be directly accessible from Route 3 (main gate and residential gate) and Route 3A (tactical vehicle and commercial gate). The proposed main gate would be located off Route 3 near Potts Junction and would provide direct access to the cantonment. The family housing area would be accessed by a residential gate off Route 3 at the southeastern corner of the site.

Grading requirements for construction of the cantonment/family housing areas and associated infrastructure for Alternative A would include 3,159,000 cubic yard (yd^3) (2,415,230 cubic meter [m^3]) of cut (excavation) and 2,483,000 yd^3 (1,898,391 m^3) of fill, resulting in a net of 676,000 yd^3 (516,839 m^3) of cut material available for use as needed.

Utilities

As described below, on-site utilities development under Alternative A would include buried electrical, communication, water, and wastewater lines generally along existing or proposed roadways, a new electrical substation, two communication area distribution nodes, two ground level water storage tanks with pumped pressurization system and emergency backup generator, four wastewater pump stations (WWPS), a recycling facility, and a solid waste transfer facility. In addition, as shown in Figure 2.4-5, additional alternative-specific tie-ins of electrical, water, and wastewater lines would be implemented (mostly along existing utility and roadway corridors for Routes 3 and 9) to connect the new on-base infrastructure to existing utility networks.

Other off-site utility improvements common to all alternatives are covered in Section 2.4.4.6 and shown in Figure 2.4-14. Underground electrical lines would be in conduit buried up to approximately 3.5 feet (1.0 m) deep in its own dedicated trench, and water and wastewater lines would be buried at least 3.0 feet (0.9 m) deep and not more than approximately 5.0 feet (1.5 m) deep, with approximately 10.0 feet (3.0 m) of separation between their respective trenches. For purposes of this SEIS, a maximum potential impact corridor of 50.0 feet (15.2 m) wide is assumed.

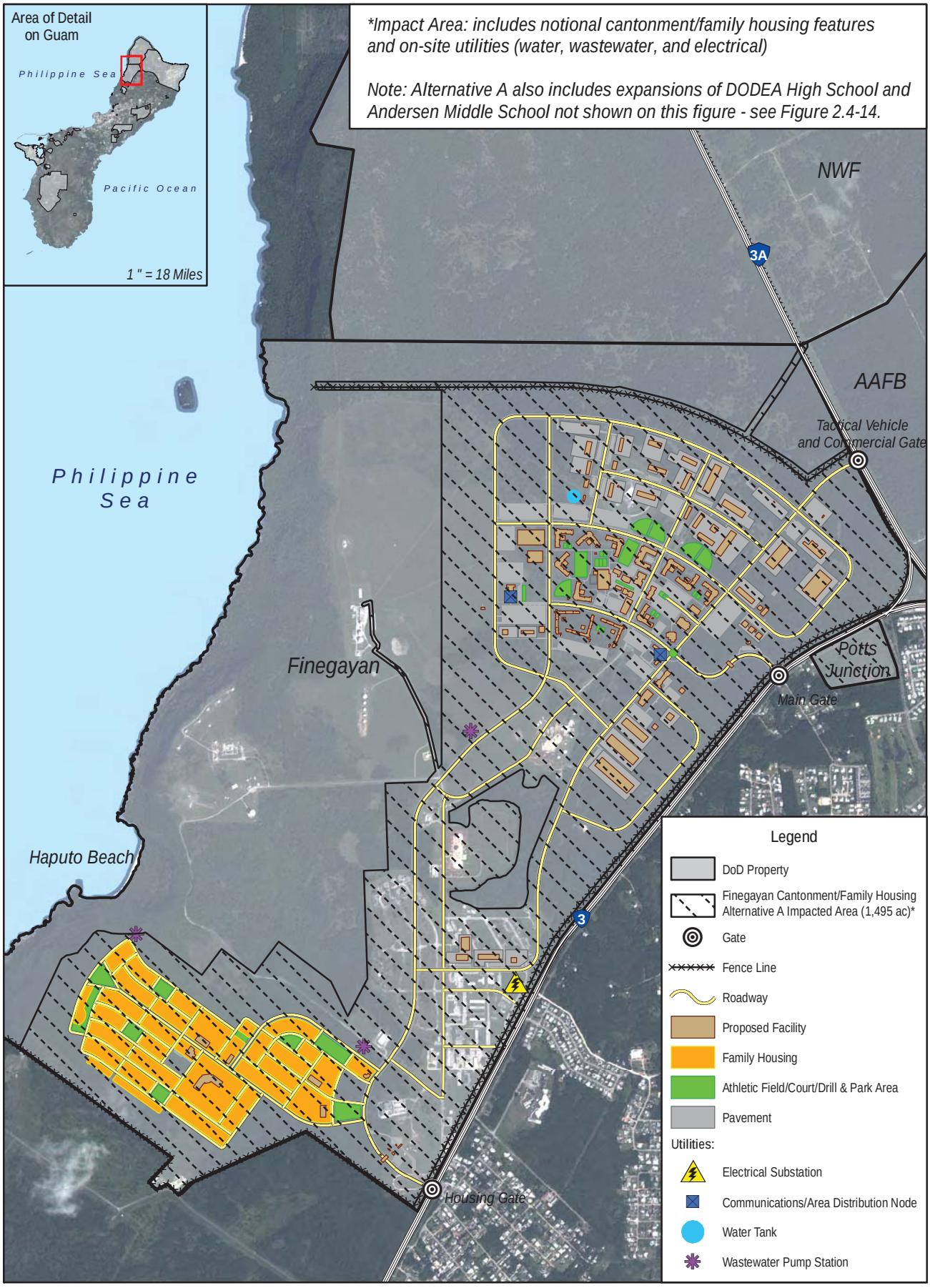


Figure 2.4-4
Finegayan Cantonment/Family Housing Alternative A

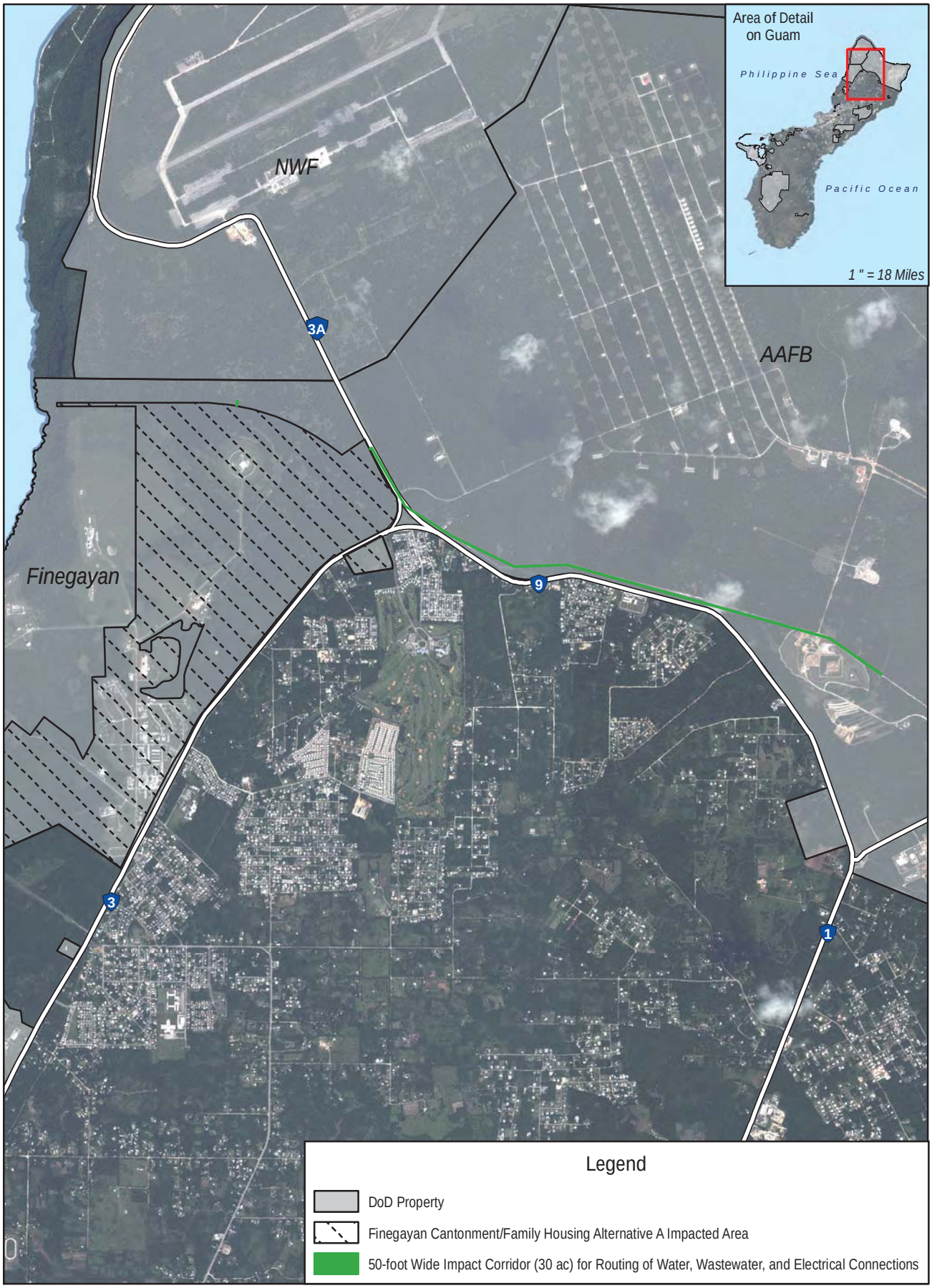


Figure 2.4-5
Proposed Utility Routing for Finegayan Cantonment/Family Housing Alternative A

Source: NAVFAC Pacific 2013

Electrical Power

Although the existing substation would remain operational to serve current loads in North Finegayan and provide the necessary generator backup capability for mission-critical and emergency loads, a new substation would be constructed to serve the proposed cantonment and family housing areas. Electrical distribution throughout the cantonment and family housing areas would be via an underground 13.8 kilovolt (kV) distribution line. The new power distribution system would be installed in underground concrete encased conduit duct banks. The width of the conduit duct banks would depend on how many conduits are needed, but for power distribution, this should be within 2.0 feet (0.6 m) to 4.0 feet (1.2 m). Pad mounted distribution transformers would be provided throughout the development as required, and emergency generators would provide backup power for critical facilities. Critical facilities within sufficient proximity of each other could be served by a common emergency generator to minimize the number of generators required.

Potable Water

Currently, two elevated 250,000 gallon (946,353 liter) storage tanks are located along Route 3 in Finegayan and South Finegayan. A new 500,000 gallon (1,892,706 liter) concrete ground-level water storage tank would be installed adjacent to the existing 200,000 gallon (757,082 liter) concrete ground-level water storage tank, B144, located near the North Finegayan existing elevated storage tank, to meet current demand requirements, including fire protection. The new concrete ground-level water storage tank would have an updated supervisory control and data acquisition system and connection to the Harmon Booster Pump Station to support the required fire flow and water demand to the new 500,000 gallon ground-level tank. This new tank would remain part of the water system serving the existing facilities and is not part of the proposed action. Both elevated water storage tanks located at Finegayan and South Finegayan would be demolished.

Increased water supply for the cantonment/family housing would come from the proposed new well field at AAFB and excess water from existing DoD water systems (to include the rehabilitated wells). Rehabilitation has been completed or is in process and thus is not part of the proposed action covered within this SEIS, but the new proposed well field of approximately 11 new wells is part of the proposed action. The new wells would feed a new well field collection tank and water treatment facility (chlorination and fluoridation). This water supply would feed a new ground-level water storage tank that would be provided within the proposed cantonment area. To service the family housing area, a separate water storage tank will be built in the family housing area or next to the new ground tank at the cantonment area. The new potable water distribution pipes would be installed underground at least 3.0 feet (0.9 m) deep. The width of the trench to install the pipes would be about 1.5 feet (0.5 m) to 4.0 feet (1.2 m) for 6 inch (15 centimeters [cm]) to 24 inch (61 cm) pipes.

Wastewater

A new wastewater collection system for Alternative A would include a network of gravity mains, manholes, WWPS, and force mains. The new system would tie into the GWA wastewater collection system at a manhole on Route 3. Wastewater would be conveyed to the Northern District WWTP for treatment and disposal. Upgrades to the Northern District WWTP are already needed in order for the plant to achieve compliance with the current NPDES permit requirements.

The new wastewater collection system would be installed underground at least 3.0 feet (0.9 m) deep and not more than approximately 5.0 feet (1.5 m) deep. The width of the installation trench would be approximately 2.0 feet (0.6 m) to 3.0 feet (0.9 m) wide. Larger excavations would be required for the installation of manholes.

Solid Waste

The GovGuam Layon Landfill would continue to be used for solid waste disposal. Construction and demolition debris would be processed for reuse or disposed in existing disposal facilities in accordance with all regulatory requirements, EOs, and DoD requirements. The DON is currently coordinating with the Guam Environmental Protection Agency (GEPA) regarding the status of the permit for the Naval Base Guam Landfill. Disposal of wastes at the Naval Base Guam Landfill would be consistent with solid waste permit terms and conditions. The Solid Waste Working Group consisting of the DoD, GEPA, and USEPA was established to coordinate and resolve landfill permitting issues and other solid waste issues on Guam. Green waste composting and construction recycling would be pursued on-site during the construction process. A new solid waste transfer facility and a waste recycling facility would be constructed for Alternative A.

2.4.4.2 Finegayan Cantonment/South Finegayan Housing - Alternative B

The Finegayan cantonment/South Finegayan housing alternative (Alternative B), as shown in Figure 2.4-6, would comprise approximately 1,450 acres (587 ha) of federally owned land. The cantonment area of this alternative would be in the same location as the proposed cantonment for Alternative A, discussed in Section 2.4.4.1. The housing area would be located at the South Finegayan site, approximately 1.0 mile (1.6 km) from the southern boundary of Finegayan. The portion of the South Finegayan parcel proposed for development of family housing covers approximately 290 acres (117 ha). The proposed housing density at South Finegayan would comply with the Marine Corps density range.

Access to the Finegayan cantonment area would be via a new Main Gate off Route 3 at Potts Junction and a tactical vehicle and commercial gate off Route 3A. The South Finegayan family housing area would be accessible off Route 3 via a new residential gate.

Grading requirements under Alternative B (comprising the Finegayan and South Finegayan components) would include 3,245,000 yd^3 (2,480,980 m^3) of cut (excavation) and 2,731,000 yd^3 (2,087,999 m^3) of fill, resulting in a net of 514,000 yd^3 (392,981 m^3) of cut material available for use as needed.

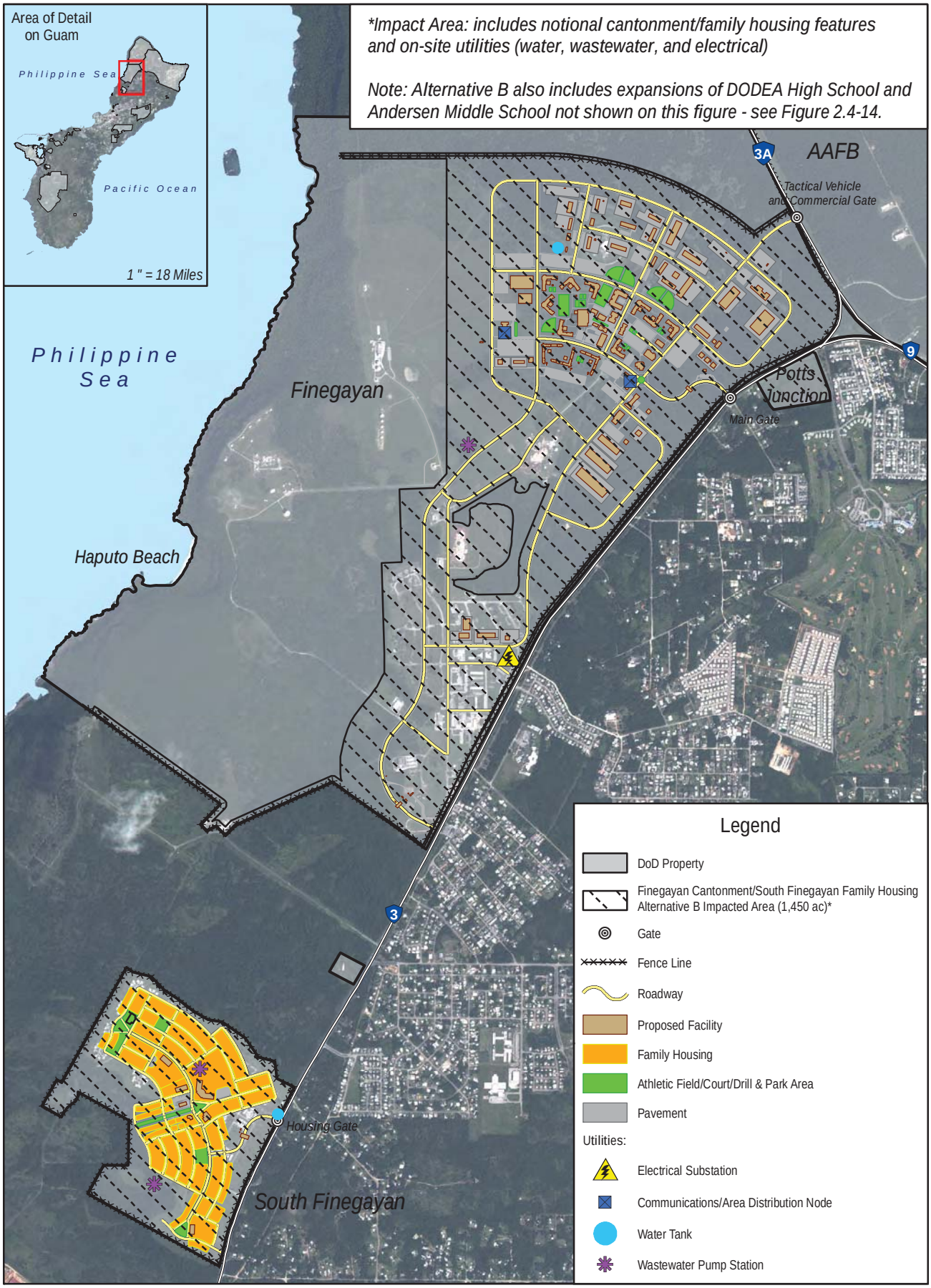


Figure 2.4-6
Finegayan Cantonment/South Finegayan
Family Housing Alternative B

Utilities

As described below, on-site utilities development under Alternative B would include buried electrical, communication, water, and wastewater lines generally along existing or proposed roadways, a new electrical substation, two communication area distribution nodes, two new ground level water storage tanks (see discussion under the Finegayan alternative) and one at the family housing area at South Finegayan, WWPS at the cantonment area and the family housing area, a waste recycling facility, and a solid waste transfer facility.

In addition, as shown in Figure 2.4-7, additional alternative-specific tie-ins of electrical, water, and wastewater lines would be implemented (mostly along existing utility and roadway corridors for Routes 3 and 9) to connect the new on-base infrastructure to existing utility networks. Other off-site utility improvements common to all alternatives are covered in Section 2.4.4.6 and shown in Figure 2.4-14. Underground electrical lines would be in conduit buried up to approximately 3.5 feet (1.0 m) deep in their own trenches, and water and wastewater lines would be buried at least 3.0 feet (0.9 m) deep and not more than approximately 5.0 feet (1.5 m) deep, with approximately 10.0 feet (3.0 m) of separation between their respective trenches. For purposes of this SEIS, a maximum potential impact corridor 50.0 feet (15.2 m) wide is assumed.

Electrical Power

Provision of electrical power to Alternative B would be the same as discussed in Section 2.4.4.1 with the addition of an underground 13.8 kV electrical line along Route 3 from the proposed new Finegayan substation to the South Finegayan family housing area. This underground 13.8 kV electrical line along Route 3 would be within a concrete encased duct bank. The width of the conduit duct banks would depend on how many conduits are needed, but for power distribution, this should be within 2.0 feet (0.6 m) to 4.0 feet (1.2 m).

Potable Water

Water service to Alternative B would be similar to the water service for Alternative A, as discussed in Section 2.4.4.1. However, this alternative would include installation of a water main extension from Finegayan to South Finegayan along Route 3, which would be installed in a trench up to approximately 5 feet (1.5 m) deep. There would be a ground-level water storage tank located at South Finegayan family housing area fed by the water storage tank(s) at Finegayan through a new underground water line along Route 3.

Wastewater

The new wastewater collection system for the cantonment area in Alternative B would be the same as discussed in Section 2.4.4.1 for Alternative A. In the family housing area, the existing GWA interceptor sewer currently goes through South Finegayan and would conflict with the proposed family housing development in Alternative B. The existing GWA interceptor sewer would be rerouted around the north and west sides of the proposed family housing area and thus be maintained as a gravity system. The family housing wastewater collection system would include a network of gravity mains, manholes, two WWPS and force mains and tie into the rerouted GWA interceptor sewer on the west side. Wastewater would be conveyed to the Northern District WWTP for treatment and disposal. Upgrades to the Northern District WWTP are already needed in order for the plant to achieve compliance with the current NPDES permit.

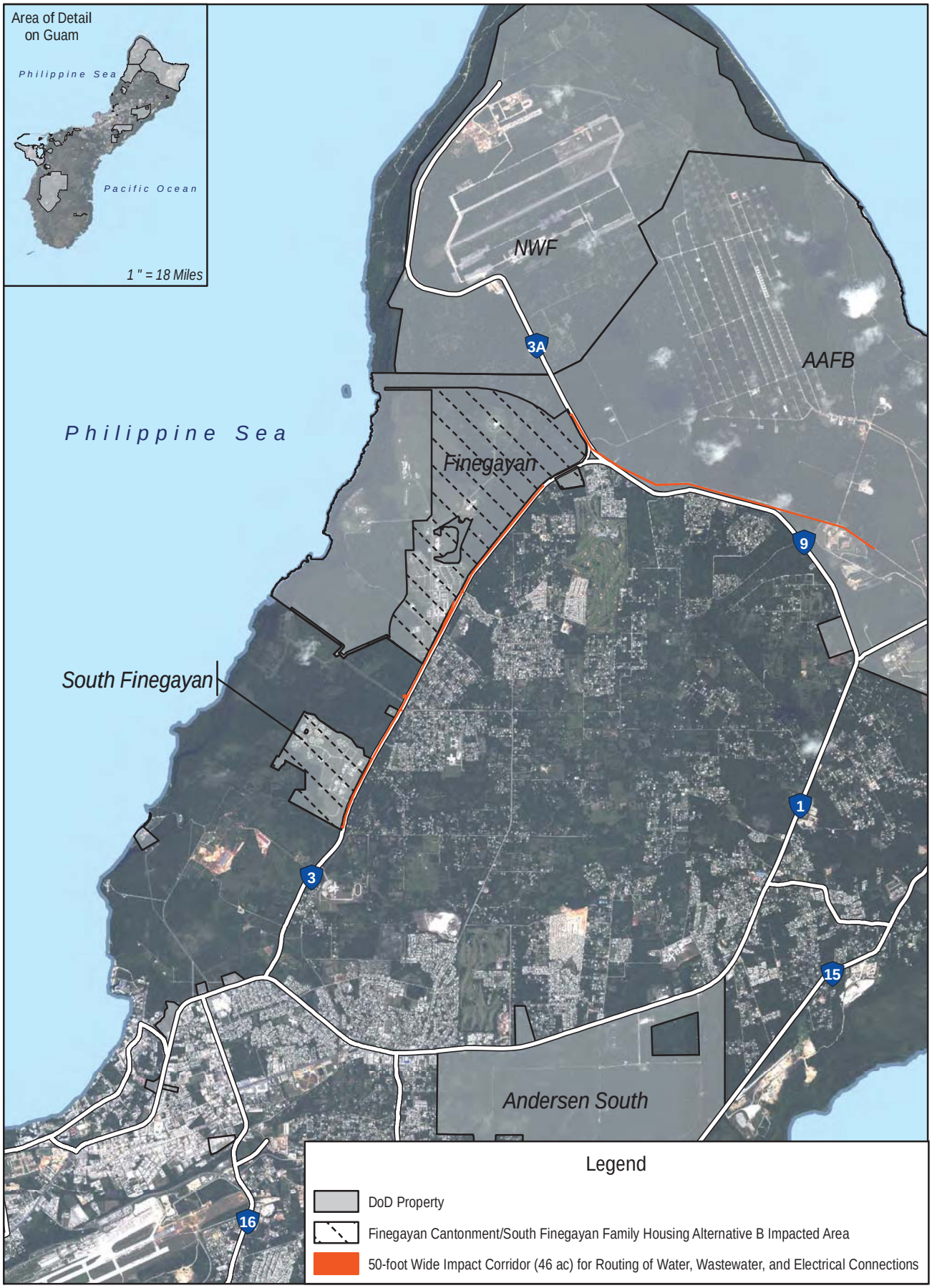


Figure 2.4-7
Proposed Utility Routing for Finegayan Cantonment/South Finegayan Family Housing Alternative B

Source: NAVFAC Pacific 2013

The new wastewater collection system would be installed underground with a minimum 3.0 feet (0.9 m) cover to approximately 5.0 feet (1.5 m) deep, or sometimes deeper if needed. The width of the installation trench would be approximately 2.0 feet (0.6 m) to 3.0 feet (0.9 m) wide. Larger excavations would be required for the installation of manholes.

Solid Waste

Solid Waste for Alternative B would be handled the same as for Alternative A, as discussed in Section 2.4.4.1.

2.4.4.3 Andersen Air Force Base Cantonment/Family Housing - Alternative C

The AAFB cantonment/family housing alternative (Alternative C) is located on AAFB, which is bounded to the north and east by the Pacific Ocean, to the south by privately-owned residential areas, and to the west by Route 9 and NWF. Alternative C would utilize approximately 1,819 acres (736 ha) of federally owned land (Figure 2.4-8). The cantonment/family housing areas of Alternative C would not be contiguous, but both areas would be contained within the same installation fence line.

Grading requirements for construction of the cantonment/family housing areas and associated infrastructure would include 2,390,000 yd^3 (1,827,286 m^3) of cut and 2,652,000 yd^3 (2,027,599 m^3) of fill, resulting in a net requirement of 262,000 yd^3 (200,313 m^3) of fill.

Access to the cantonment would occur from the existing Main Gate on Route 1 and from Route 9 through the North Gate. However, the Main Gate would need to be expanded to accommodate the new loading for the cantonment.

The family housing area for Alternative C would be located at the current AAFB family housing area approximately 2 miles (3.2 km) southeast of the proposed cantonment area. The proposed housing density at AAFB is 5.5 units per acre (final configuration is subject to change; Figures 2.4-8 and 2.4-14 provides a notional layout). The family housing area would be accessed by the existing family housing gate (the Santa Rosa Gate) at the northern end of Route 15, or from the AAFB Main Gate off Route 1. Existing family housing would be demolished and a maximum 912 family housing units would be constructed as replacements for existing AAFB housing in addition to the 535 family housing units required for Marine Corps families. The total of 1,447 maximum family housing units would be integrated into one large housing pool where all eligible personnel and families would live. The total number of housing units will continue to be refined, but the analyses in this SEIS are based upon the number of units identified above.

Existing community support facilities would be expanded or replaced, including the child development center, youth center, clinic, and temporary lodging facility. Other facilities that could be impacted and require expansion or replacement include the commissary, dining facility, fitness center, theater, library and chapel(s). These facilities would be the subject of a follow-on community support assessment. Other new facility construction under the AAFB cantonment/family housing alternative would include a new temporary lodging facility, a new community center with outdoor swimming pool, and a new Family Support Center. Navy, Marine Corps, and Air Force planners will coordinate with the Defense Commissary Agency on future commissary alternatives, to include evaluation of a new commissary adjacent to the existing base exchange.

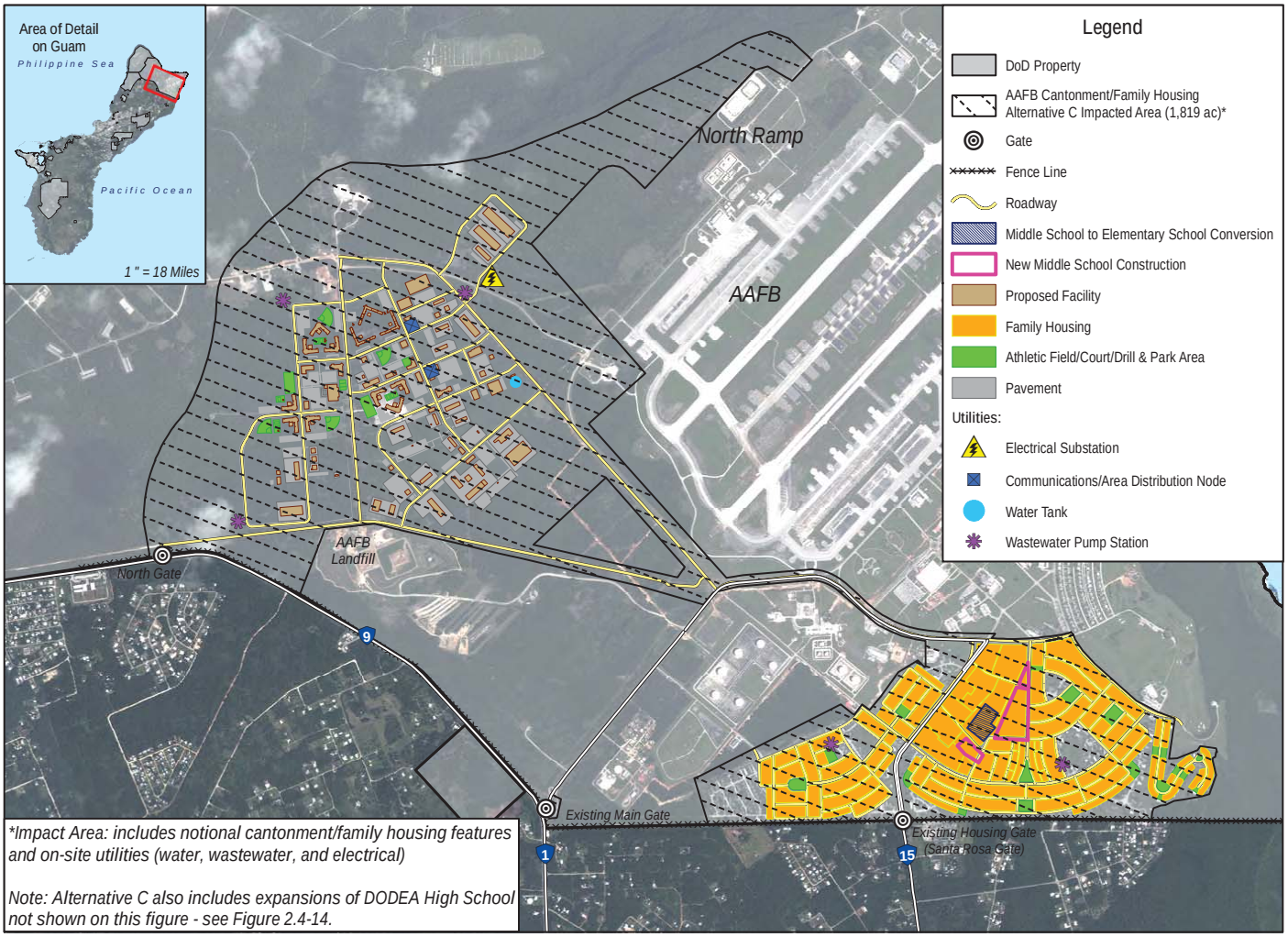


Figure 2.4-8
AAFB Cantonment/Family Housing Alternative C

Source: NAVFAC Pacific 2013

Utilities

As described below, on-site utilities development under Alternative C would include buried electrical, communication, water, and wastewater lines generally along proposed or existing roadways, and a new electrical power distribution system for the cantonment hooked to a dedicated substation to be fed from the planned North Ramp switching station. The installation of the switching station is not part of the proposed action. Alternative C would also include a new water storage tank, five new WWPS and refurbishment of two existing WWPS, a waste recycling facility, a solid waste transfer facility, and two communications area distribution nodes. The existing capacities of the utilities for the proposed AAFB family housing area are deemed adequate for the proposed redeveloped area. The proposed increase in the number of housing units and other facilities is small compared to the existing housing and other facilities. Additionally, the new facilities would implement energy and water efficient features, which would reduce utility requirements. Revised distribution for electrical power, water, and wastewater collection would be required.

In addition, as shown in Figure 2.4-9, additional alternative-specific tie-ins of water and wastewater lines would be implemented (mostly along portions of interior AAFB roadway corridors and a portion of Route 9) to connect the new on-base infrastructure to existing utility networks. Other off-site utility improvements common to all alternatives are covered in Section 2.4.4.6 and shown in Figure 2.4-14. The underground electrical line would be buried up to approximately 3.5 feet (1.0 m) deep in its own dedicated trench, and water and wastewater lines would be buried with at least 3.0 feet (0.9 m) deep to not more than approximately 5.0 feet (1.5 m) deep, with approximately 10.0 feet (3.0 m) of separation between their respective trenches. For purposes of this SEIS, a maximum potential impact corridor 50.0 feet (15.2 m) wide is assumed.

Electrical Power

The planned switching station for the North Ramp projects would be located just east of the proposed cantonment area and would have adequate power capacity to support the proposed development. For the AAFB Alternative, the plan is to install a dedicated substation for providing power to the cantonment. This substation would be fed from the 34.5kV transmission at AAFB substation. A dedicated 34.5kV underground line from the AAFB substation to this substation would be constructed. The installation of the switching station is not part of the proposed action. Small pad mounted distribution transformers would be located in the cantonment area to provide power for facilities. Additionally, emergency generators would provide backup power for critical facilities. The new power distribution system would be installed in underground concrete encased conduit duct banks and properly spaced manholes. The width of the conduit duct banks would depend on how many conduits are needed, but for power distribution, this should be within 2.0 feet (0.6 m) to 4.0 feet (1.2 m).

Potable Water

Increased water supply for the cantonment area would come from the new well field at AAFB and excess water from the DoD water system (to include the rehabilitated wells). Rehabilitation has been completed or is in progress and thus is not part of the proposed action covered within this SEIS, but the new proposed well field of approximately 11 new wells is part of the proposed action. The new wells would feed a new well field collection tank, pump and water treatment facility (chlorination and fluoridation). The cantonment area would be provided with a new ground level water storage tank supplied by the new well field storage tank. Pumped pressurization with an emergency generator for backup power would be utilized.

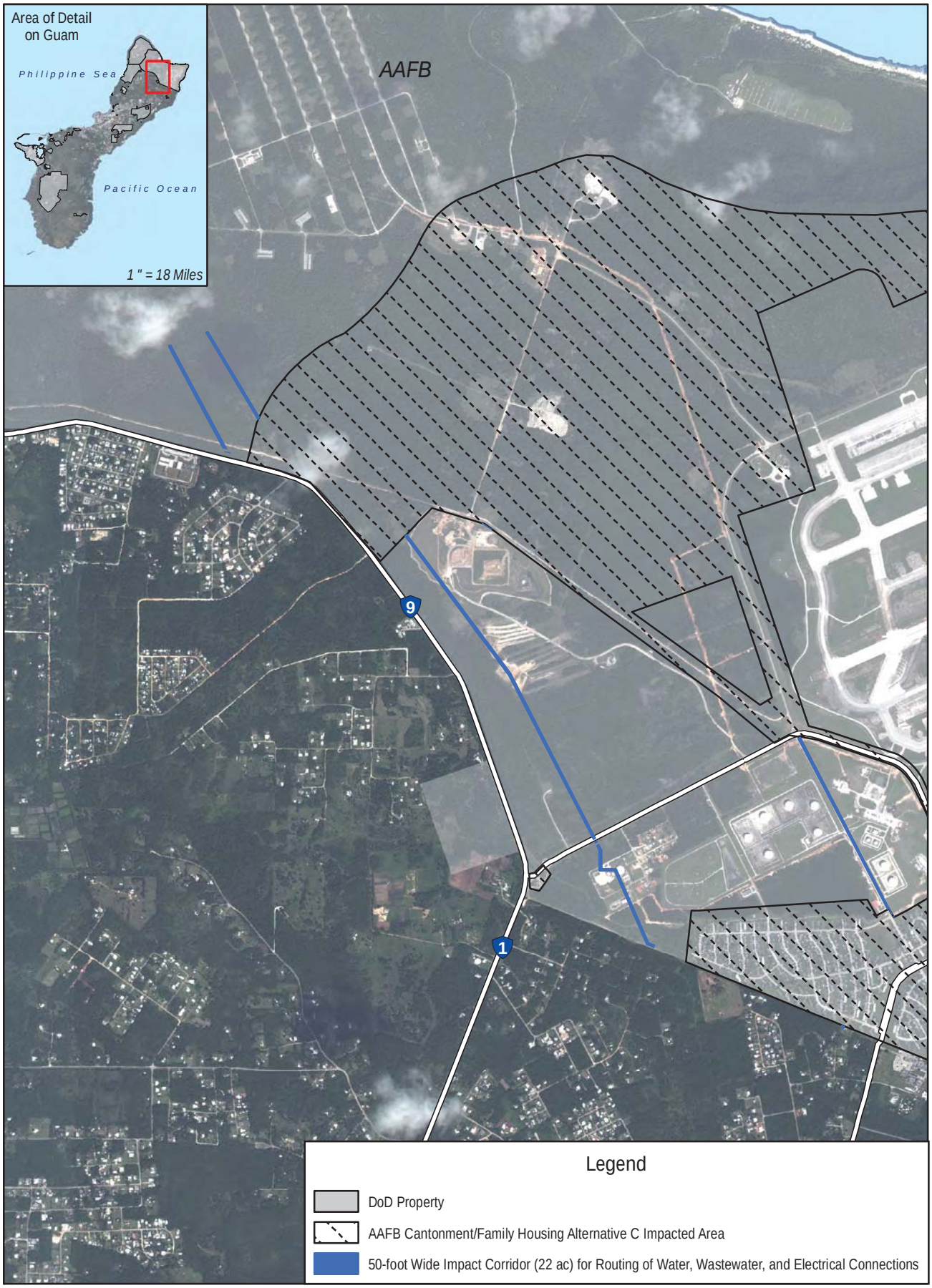


Figure 2.4-9
Proposed Utility Routing for AAFB
Cantonment/Family Housing Alternative C

Alternatively, the proposed new well field water collection tank could feed into the existing AAFB storage tank and new distribution piping installed along Marianas Boulevard to the proposed new water storage tank with a pumped pressurization system at the cantonment, which would provide the water supply. This SEIS evaluates both options, but should Alternative C become the preferred alternative, these options would be studied more in depth in order to select the best approach.

Water for the family housing area would be provided by the current AAFB water system that would be tied into the proposed new well field. The existing housing area water distribution system would be modified to reroute the system for the new road alignments desired for the family housing layout.

The new potable water distribution pipes would be installed underground at least 3.0 feet (0.9 m) deep. The width of the trench to install the pipes would be about 1.5 feet (0.5 m) to 4.0 feet (1.2 m) for 6 inch (15 cm) to 24 inch (61 cm) pipes.

Wastewater

The new wastewater collection systems for the cantonment and family housing of Alternative C would be separate systems. The cantonment wastewater collection system would include a network of gravity mains, manholes, WWPSs, and force mains. The cantonment system would discharge into the GWA collection system at an existing manhole on Route 9 near the new access road entrance to the new North Gate and be conveyed to the Northern District WWTP for treatment and disposal. The family housing wastewater collection system would include a network of gravity mains, manholes, two new WWPSs, force mains and refurbishment of existing WWPSs #1881 and #1089. The family housing wastewater collection system would utilize the existing connection to the GWA wastewater collection system and would remain as is. Existing WWPS #1295 would be demolished as part of the proposed action. Wastewater would be conveyed to the Northern District WWTP for treatment and disposal. Upgrades to the Northern District WWTP are already needed in order for the plant to achieve compliance with the current NPDES permit.

The new wastewater collection system would be installed underground with a minimum 3.0 feet (0.9 m) cover to approximately 5.0 feet (1.5 m) deep, or sometimes deeper if needed. The width of the installation trench would be approximately 2.0 feet (0.6 m) to 3.0 feet (0.9 m) wide. Larger excavations would be required for the installation of manholes.

Solid Waste

Solid waste generated during construction of Alternative C, including the construction and demolition debris generated by the demolition of the existing family housing and construction of new family housing would be handled as described for Alternative A in Section 2.4.4.1. A new waste recycling facility and solid waste transfer facility would be constructed for Alternative C cantonment. The existing solid waste recycling center and transfer facilities at AAFB are at capacity, so new facilities to accommodate the operation of the proposed cantonment/family housing area would be constructed in the vicinity of the cantonment. Planned solid waste infrastructure includes construction of a separate solid waste transfer station and recycling facility, apart from the existing temporary transfer station and Arc Light Recycling Facility. The additional transfer station and recycling facility would be built within the industrial area footprint and would support the Marine Corps cantonment apart from the existing facilities that would continue to support the Air Force requirements. Alternatively, if feasible, the existing AAFB solid waste transfer station and recycling center could be expanded. Family housing areas would continue to have their solid waste handled as currently done for the existing AAFB housing area.

2.4.4.4 Barrigada Cantonment/Housing - Alternative D

The Barrigada cantonment/family housing alternative (Alternative D) is located on the eastern side of Guam, with Route 15 bordering the site to the east and south, and Routes 16 and 10 to the west. Existing land uses in the northern section of the Barrigada property include DoD communication high frequency transmitting activities, headquarters facilities for the Guam Army National Guard, and facilities used by the Army Reserve and the Navy's Space and Naval Warfare Systems Command. A portion of the southernmost part of the Barrigada property is used by the Air Force to accommodate the NEXRAD weather facility. The northern and southern sections of the Barrigada property are connected by a strip of open space that was the former Nimitz Golf Course.

Alternative D would comprise approximately 1,194 acres (483 ha) of federally owned land (Figure 2.4-10). The cantonment and family housing areas would be located on one contiguous parcel of land, although the family housing area would be separated from the cantonment by approximately 1.5 miles (2.4 km). The cantonment would be located in the southern part of the site near Route 15. Base support facilities would occupy the former Nimitz Golf Course and would connect the cantonment core to the family housing area to the north. The proposed housing density at Barrigada would comply with the Marine Corps density range. In addition to the proposed facilities for cantonment/family housing within the Barrigada property, Alternative D would also include construction of a BEQ with 300 rooms and a BOQ with 100 rooms on AAFB, as shown in the inset map on Figure 2.4-10. The BEQ and BOQ would be for the military personnel associated with the ACE facilities on AAFB.

The cantonment area would be accessed via a new Main Gate off Route 15 and a new commercial gate off Route 15. The family housing area would be accessed via a new residential gate off Route 16 just north of the existing gate to the Guam Army National Guard site.

Grading for construction of the cantonment/family housing areas and associated infrastructure under Alternative D would include 3,510,000 yd^3 (2,683,589 m^3) of cut (excavation) and 2,618,000 yd^3 (2,001,606 m^3) of fill, resulting in a net of 892,000 yd^3 (681,983 m^3) of cut material available for use as needed.

Utilities

As described below, on-site utilities development under Alternative D would include buried electrical, communication, water, and wastewater lines generally along existing or proposed roadways, a new electrical substation, two communications area distribution nodes, a new water storage tank adjacent to the existing water storage tank (unless subsequent studies find the existing water storage tank adequate), four new WWPS, a waste recycling facility, and a solid waste transfer facility.

In addition, as shown in Figure 2.4-11, additional alternative-specific tie-ins of electrical, water, and wastewater lines would be implemented (mostly along portions of existing utility and roadway corridors for Routes 3, 1, 16, and 8) to connect the new on-base infrastructure to existing utility networks. Other off-site utility improvements common to all alternatives are covered in Section 2.4.4.6 and shown in Figure 2.4-14. The off-site electrical line upgrade would be overhead and part of the GPA system and include a communication line for GPA purposes. Water and wastewater lines would be buried at least 3.0 feet (0.9 m) deep and not more than approximately 5.0 feet (1.5 m) deep, with approximately 10.0 feet (3.0 m) of separation between their respective trenches. For purposes of this SEIS, a maximum potential impact corridor 50.0 feet (15.2 m) wide is assumed.

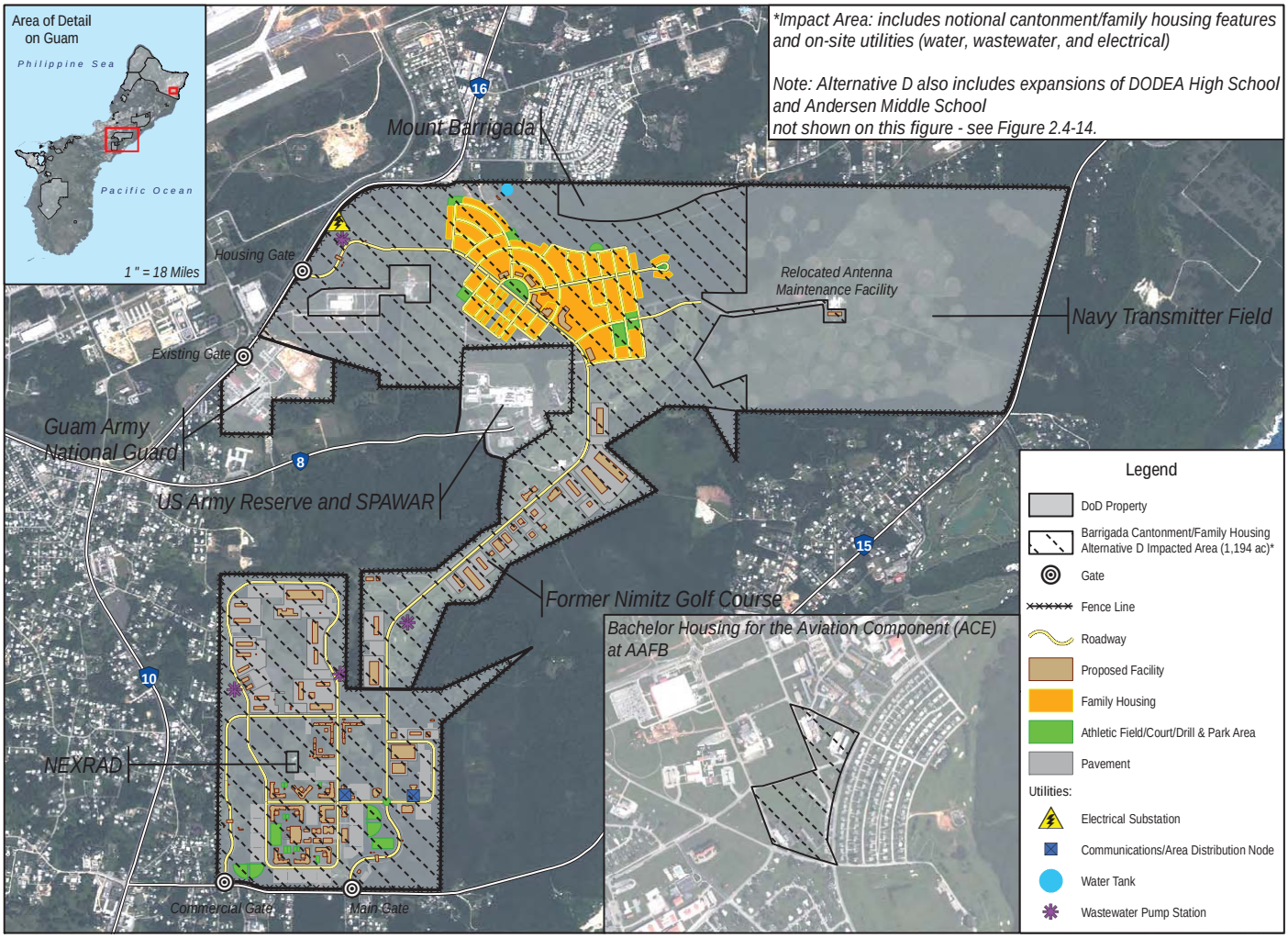


Figure 2.4-10
Barrigada Cantonment/Family Housing Alternative D

Source: NAVFAC Pacific 2013

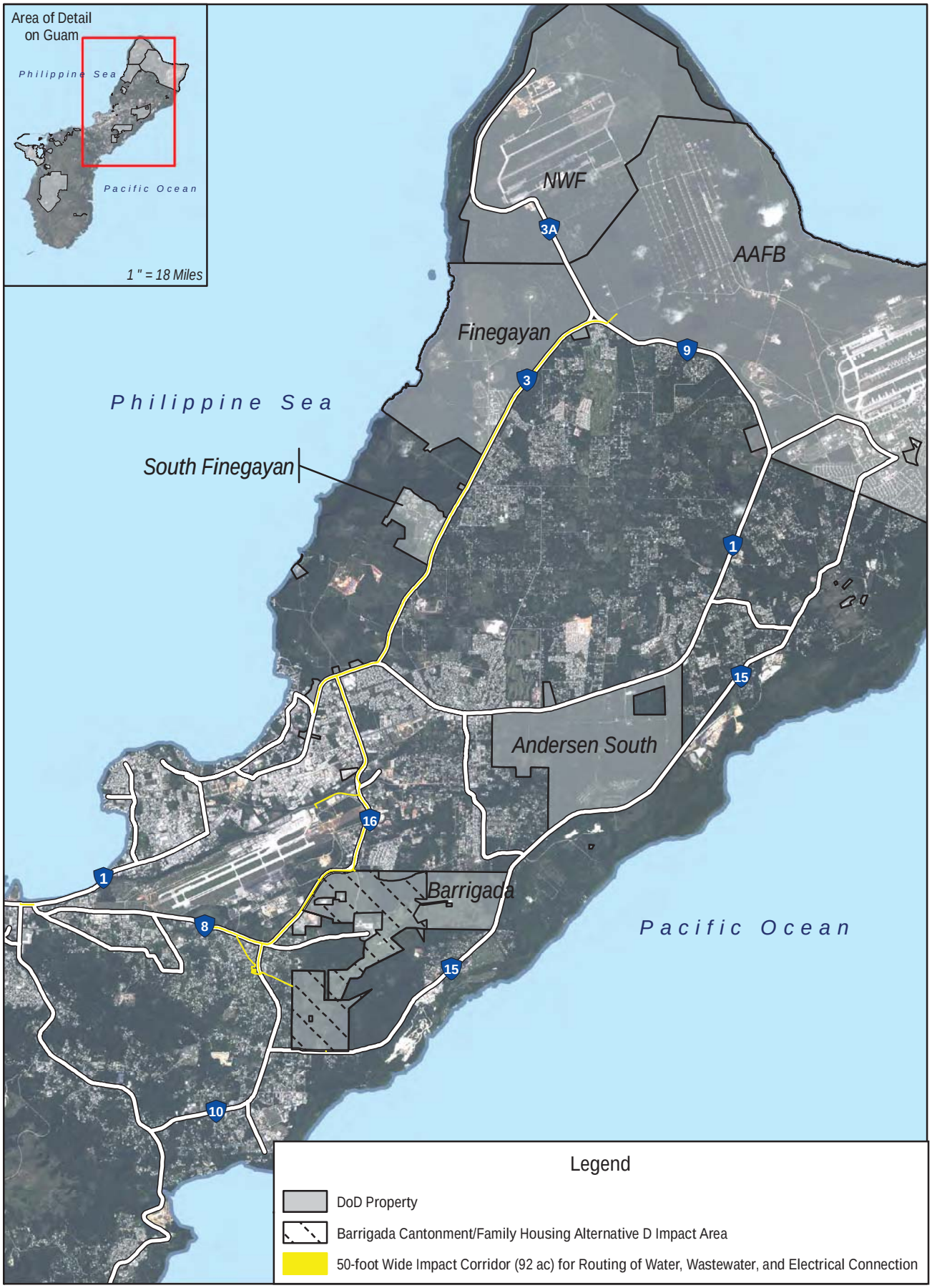


Figure 2.4-11
Proposed Utility Routing for Barrigada Cantonment/Family Housing Alternative D

Electrical Power

The existing GPA circuits from the existing GPA Barrigada Substation and the GPA Guam Airport Authority Substation would support the existing and planned loads at the Barrigada site. To facilitate this additional support, the transmission lines between those two existing substations would require upgrades along with a new communication line. A new substation would be constructed near the proposed family housing gate along Route 16 and tie into the upgraded GPA transmission line. This substation, along with the distribution transformers throughout the development, would provide power to the cantonment and housing areas. Emergency generators would provide backup power for critical facilities.

The new power distribution system would be installed in underground conduit in concrete encased duct banks. The width of the conduit duct banks would depend on how many conduits are needed, but for power distribution, this should be within 2.0 feet (0.6 m) to 4.0 feet (1.2 m).

Potable Water

Increased water supply for the proposed action would come from the new well field at AAFB, excess water from existing DoD water systems, and the rehabilitated wells. Rehabilitation has been completed or is in process and thus is not part of the proposed action covered within this SEIS, but the new proposed well field of approximately 11 new wells is part of the proposed action. The new wells would feed a new well field collection tank and water treatment facility (chlorination and fluoridation). This water supply would feed Barrigada from the proposed water transmission system along Route 3 and Route 16. The existing water main along Route 16 would require upgrades from the Harmon Pump Station to the proposed new water storage tank adjacent to the existing Barrigada water storage tank. Should subsequent water system studies find the existing Barrigada water storage tank adequate to serve the proposed development at Barrigada, then the new tank would not be necessary. A main distribution line would be constructed from the proposed new water storage tank down the middle of the housing area and to the southern part of the cantonment. A connection to the existing DoD water main on Route 16 would be made for use in emergency situations to facilitate receiving water from southern sources, but would not be adequate for full service.

The new potable water distribution pipes would be installed underground at least 3.0 feet (0.9 m) deep. The width of the trench to install the pipes would be about 1.5 feet (0.5 m) to 4.0 feet (1.2 m) for 6 inch (15 cm) to 24 inch (61 cm) pipes.

Wastewater

Wastewater generated from Alternative D would be collected, conveyed to, treated, and disposed of at the Agaña WWTP for facilities located at Navy Barrigada, and at the Northern District WWTP for facilities located at AAFB. Upgrades to both WWTPs are already needed in order for the plants to achieve compliance with the current NPDES permits.

The new wastewater collection system for the cantonment and family housing in Alternative D would include a network of gravity mains, manholes, WWPS, and force mains. A new sewer main would be required off-base to tie into the existing GWA wastewater collection system on Route 10 where wastewater is pumped to an existing gravity main along Route 8 by the GWA Barrigada pump station. Upgrades to the GWA Barrigada pump station and force main would be required. As an option, a new off-base WWPS could be installed along Route 10 and/or a new force main installed north along Route 10 and west along Route 8. Wastewater from both options would connect to the existing GWA gravity main along Route 8 and be conveyed west to Route 1 to the Agaña WWTP for treatment and disposal. Both options are evaluated in this SEIS.

The new wastewater collection system would be installed underground with a minimum 3.0 feet (0.9 m) cover to approximately 5.0 feet (1.5 m) deep, or sometimes deeper if needed. The width of the installation trench would be approximately 2.0-feet (0.6-m) to 3.0-feet (0.9-m) wide. Larger excavations would be required for the installation of manholes.

Solid Waste

There are no existing solid waste facilities at Barrigada. Solid waste generated during construction would be handled as described for Alternative A in Section 2.4.4.1. A new waste recycling facility and solid waste transfer facility would be constructed for Alternative D.

2.4.4.5 Finegayan Cantonment/AAFB Family Housing - Alternative E

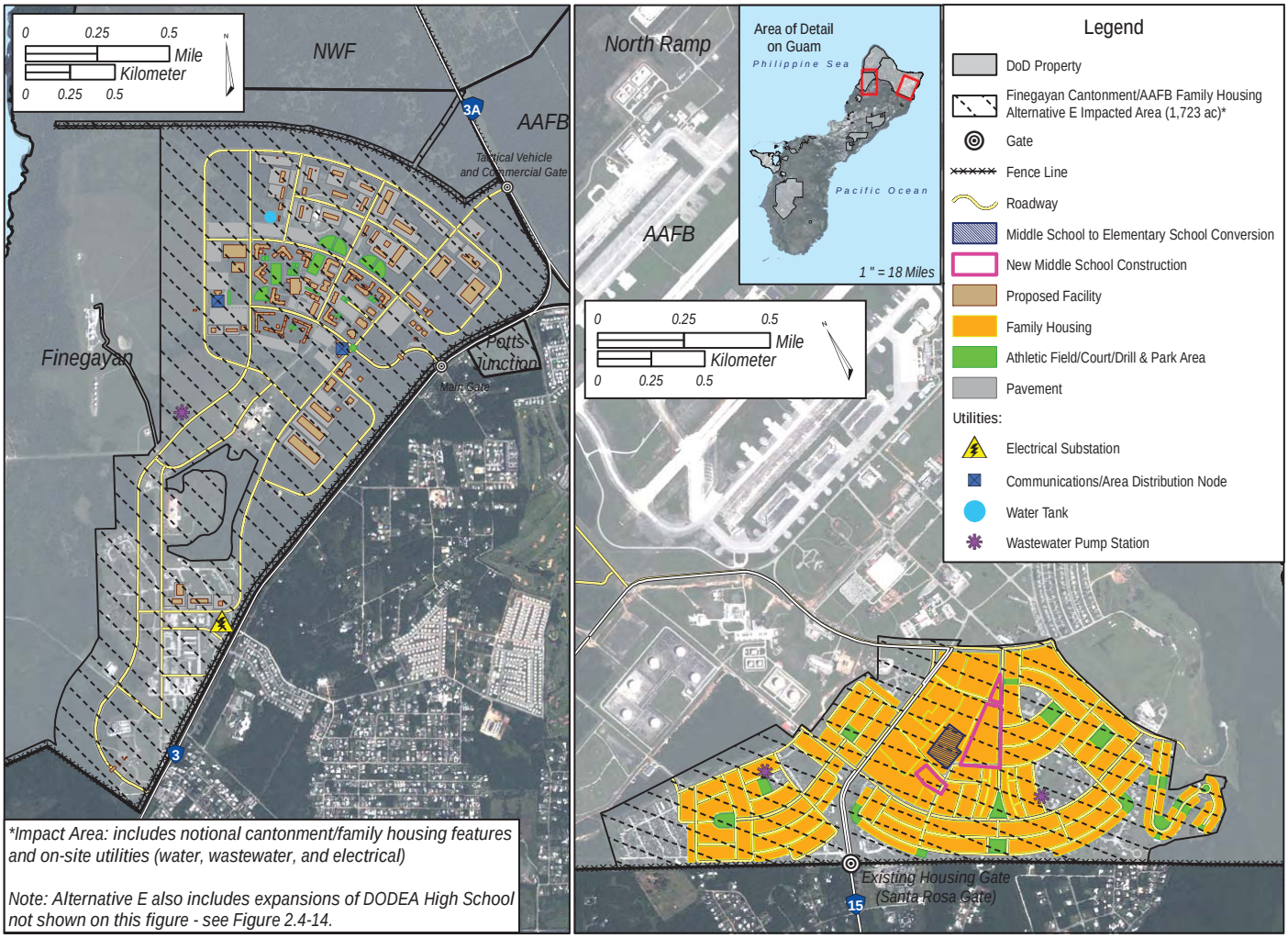
The Finegayan cantonment/AAFB family housing alternative (Alternative E), as shown in Figure 2.4-12, would comprise approximately 1,723 acres (697 ha) of federally owned land. The cantonment for this alternative would consist of 1,213 acres (491 ha) and would be in the same location as the proposed cantonment for Alternatives A and B, discussed in Sections 2.4.4.1 and 2.4.4.2, respectively.

The family housing area for Alternative E would consist of 510 acres (206 ha) located at the current AAFB family housing area. The proposed housing density at AAFB is 5.5 units per acre (final configuration is subject to change; Figure 2.4-12 and 2.4-14 provides a notional layout). The family housing area would be accessed by the existing family housing gate (the Santa Rosa Gate) at the northern end of Route 15, or from the AAFB Main Gate off Route 1 (the latter is assumed in traffic modeling conducted for this SEIS). Existing family housing would be demolished and a maximum of 912 family housing units would be constructed as replacements for existing AAFB housing in addition to the 535 family housing units required for Marine Corps families. The total of up to 1,447 family housing units would be integrated into one large housing pool where all eligible personnel and families would live. The total number of housing units will continue to be refined, but the analyses in this SEIS are based upon the number of units identified above.

Community support facilities exist for families currently residing at AAFB. These existing facilities would be assessed collaboratively with planners from the Navy, Marine Corps, and Air Force in follow-on analyses to determine the level of improvements that may be required. Examples of these facilities include, but are not limited to, a child development center, exchanges, family support services, and a commissary. These support facilities would take into consideration the timing and programming needs of all future stakeholders at AAFB.

Access to the Finegayan cantonment area would be via a new Main Gate off Route 3 at Potts Junction and via a Tactical Vehicle and Commercial Gate off Route 3A.

Grading for construction of the cantonment/family housing areas and associated infrastructure under Alternative E (comprising the Finegayan and AAFB components) would include 3,732,871 yd^3 (2,853,984 m^3) of cut (excavation) and 2,958,469 yd^3 (2,261,911 m^3) of fill, resulting in a net of 774,402 yd^3 (92,072 m^3) of cut material available for use as needed.



*Impact Area: includes notional cantonment/family housing features and on-site utilities (water, wastewater, and electrical)

Note: Alternative E also includes expansions of DODEA High School not shown on this figure - see Figure 2.4-14.

Figure 2.4-12
Finigayan Cantonment/AAFB Family Housing Alternative E

Source: NAVFAC Pacific 2013

Utilities

As described below, on-site utilities development under Alternative E would be a combination of the cantonment utilities from Alternative A (or B) and the family housing utilities from Alternative C (Figure 2.4-13). These utilities would include electrical, communication, water, wastewater and solid waste as described in greater detail below.

Other off-site utility improvements common to all alternatives are covered in Section 2.4.4.6 and shown in Figure 2.4-14. Underground electrical lines would be in conduit buried up to approximately 3.5 feet (1.0 m) deep in its own dedicated trench, and water and wastewater lines would be buried at least 3.0 feet (0.9 m) deep and not more than approximately 5.0-feet (1.5-m) deep, with approximately 10.0 feet (3.0 m) of separation between their respective trenches. For purposes of this SEIS, a maximum potential impact corridor of 50.0-feet (15.2-m) wide is assumed.

Electrical

Finegayan Cantonment: as in Alternative A (or B), under Alternative E the existing Naval Computer and Telecommunications Station substation would remain operational to serve current loads in North Finegayan and provide the necessary generator backup capability for mission-critical and emergency loads, and a new substation would be constructed to serve the proposed cantonment. Electrical distribution throughout the Alternative E cantonment would be the same as for Alternative A (or B) cantonment area.

AAFB Family Housing: as in Alternative C, under Alternative E the existing AAFB main substation would have adequate capacity to serve the family housing, including the redeveloped housing units, new common facilities, and expanded common facilities. The distribution system would be rebuilt, enhanced, and reconfigured to accommodate the revised housing layout plan.

Potable Water

Finegayan Cantonment: the proposed water system for the Alternative E cantonment would be very similar to that depicted in Alternative A (or B). The proposed well field would remain in the same location, however the piping connection would utilize the integration with the existing AAFB water system option to enhance AAFB water supply. Other modifications from the Alternative A water plan would include elimination of the water line from the proposed new water storage tanks to the Alternative A family housing since this area would not be developed under Alternative E. The Finegayan cantonment storage tank requirements could be reduced to reflect the reduced size of the distribution system, but the storage system would remain in the same location.

AAFB Family Housing: as in Alternative C, under Alternative E the existing potable water system would have adequate capacity to supply the redeveloped family housing area. This system's reliability would be enhanced by the connection of the proposed well field storage tank to the AAFB water storage tank and system.

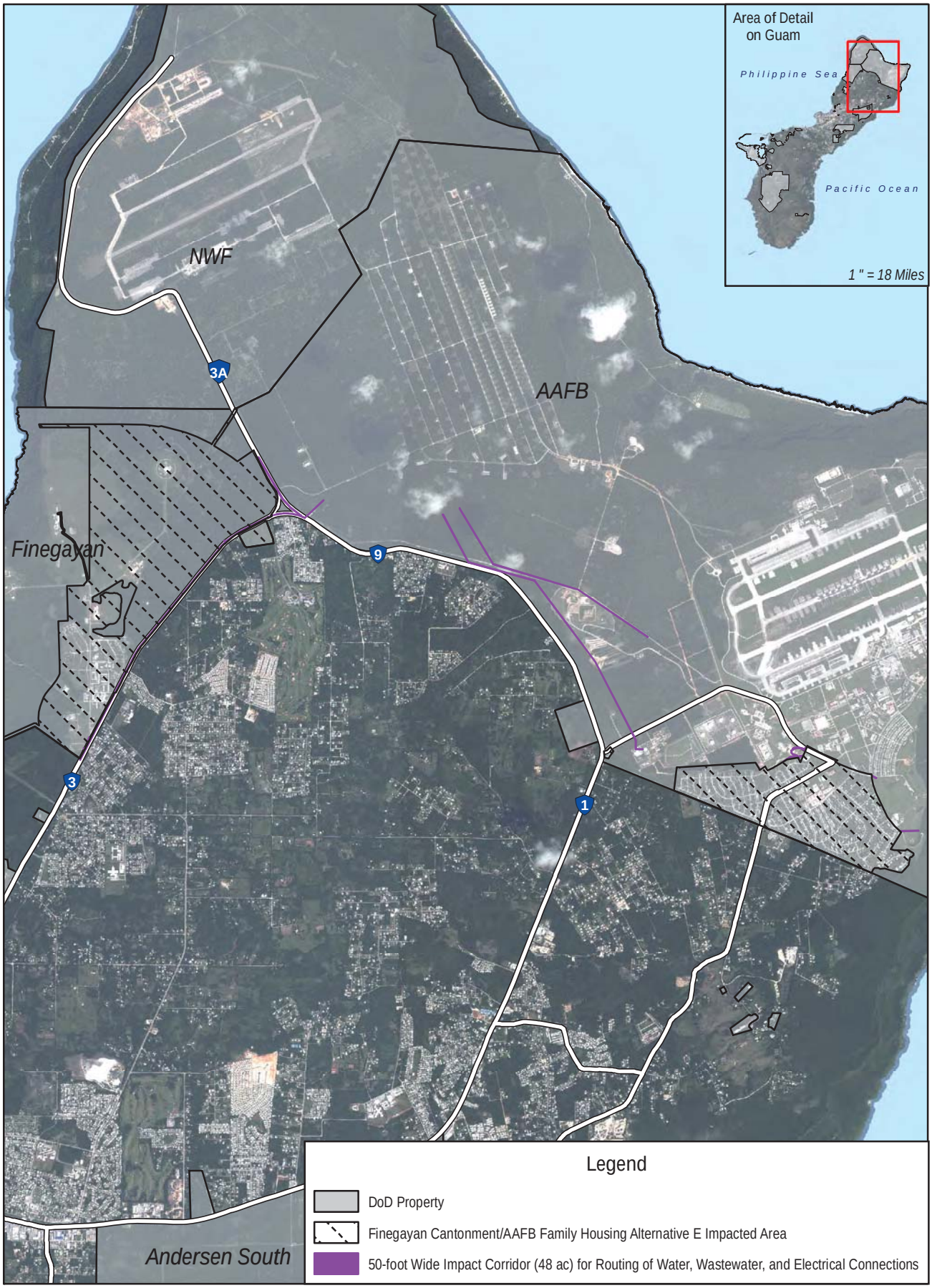


Figure 2.4-13
Proposed Utility Routing for Finegayan Cantonment/AAFB Family Housing Alternative E

Source: NAVFAC Pacific 2013

Wastewater

Finegayan Cantonment: the wastewater system for the Finegayan cantonment would be the same as described in Alternative A (or B), except that the connection to the GWA main sewer line along Route 3 would occur farther north. Also the proposed facilities at the southern end of the cantonment would utilize the existing sewer system as they generate low wastewater flows that should be manageable by the existing sewer. Wastewater would still be conveyed to the Northern District WWTP for treatment and disposal.

AAFB Family Housing: wastewater infrastructure for the Alternative E family housing would be identical to that planned for the family housing area in Alternative C.

Solid Waste

Finegayan Cantonment: solid waste infrastructure for Alternative E would be the same as described for the cantonment area for Alternative A (or B). A solid waste transfer facility and recycling center would be provided as described for Alternative A (and B).

AAFB Family Housing: solid waste infrastructure under Alternative E would be the same as described for the family housing area under Alternative C. Essentially, the existing solid waste infrastructure currently serving the AAFB housing area would continue to provide the requirements for the redeveloped family housing area under Alternative E.

2.4.4.6 Off-Site Utilities and DoD School Expansion Common to All Cantonment/Family Housing Alternatives

In addition to proposed construction of the various facilities and functions within the cantonment and family housing area and off-site utilities unique to each cantonment/family housing alternative, each alternative regardless of location would also require off-site development and extension of utility infrastructure, new water wells, and either facility expansion or conversion with new construction at existing DoD school facilities. Additional common off-site utility upgrades would be implemented under any of the five cantonment/family housing alternatives, as shown in Figure 2.4-14. These would include upgrading the existing 34.5kV transmission lines from Harmon Substation to AAFB Main Substation by installing a new underground 34.5kV line and installation of approximately 11 new water production wells. The proposed water well area would total an estimated 45.2 acres (18.4 ha), including up to 7.6 acres (3.1 ha) for the test wells and approximately 11 production wells (200 foot [61 m] diameter each), approximately 28 acres (11.3 ha) for the water lines and access roads that would connect the wells, and approximately 9.6 acres (3.9 ha) for a well field water storage tank, pumps, and treatment system. The specific number and locations of wells would be determined during well development and would consider updated water system information. Without those inputs, approximately 11 new production wells would be required to meet the UFC dictated water demand for the cantonment/family housing area.

In addition to the utilities projects that are common to all alternatives, modifications to existing DoD school facilities would also be implemented under any of the five alternatives, although the details of such modifications would differ under the alternatives involving AAFB (Alternatives C and E).

All of the cantonment/family housing alternatives would include an expansion of approximately 33,300 square feet (3,094 square m) at the existing DoDEA High School at the Naval Hospital site in central Guam (Figure 2.4-14). The three stand-alone cantonment alternatives (e.g., Alternatives A, B, and D) would also include a similar expansion of the existing Andersen Middle School located at AAFB. Under Alternative C and Alternative E (with family housing at AAFB) however, the existing Andersen Middle School facility would be repurposed as an elementary school (within the current campus area), and a new middle school would be constructed south of the existing schools (Figure 2.4-14).

2.4.5 Comparison of Cantonment/Family Housing Alternatives

Table 2.4-3 provides a comparison of the land area encompassed by each alternative discussed in Sections 2.4.4.1 through 2.4.4.6 and the No-Action Alternative described in Section 2.1. The potentially impacted area for the cantonment (not including off-site utilities and school expansions/construction) varies from 1,074 acres (435 ha) at Barrigada (Alternative D) to 1,309 acres (530 ha) at AAFB (Alternative C). The potentially impacted area for the proposed family housing varies from 115 acres (47 ha) at Barrigada (Alternative D) to 510 acres (206 ha) at AAFB (Alternative C or E). As shown in the table, any of the five SEIS alternatives for cantonment and family housing require substantially less acreage than the No-Action Alternative. For all alternatives, additional areas would be impacted by implementation of off-site utilities specific to each cantonment/family housing alternative, and the school expansions or construction (except for the No-Action Alternative, for which no DoD school construction has been identified). Estimates of the area potentially affected, especially for off-site utilities, are worst case estimates that reflect the current lack of detail in the exact placement of underground utility lines (in most instances a 50 foot (15 m) wide corridor has been assumed even though the eventual ground disturbance may be only a few feet wide).

Table 2.4-3. Summary Comparison of Land Area Potentially Impacted by Cantonment/Family Housing Alternatives (acres / ha)

	Finegayan Alternative A	***Finegayan/South Finegayan Alternative B***	***AAFB Alternative C***	***Barrigada Alternative D***	***Finegayan/ AAFB Alternative E***	***No-Action Alternative [1]***
Cantonment[2]	1,165 / 471	1,191 / 482	1,309 / 530	1,074 / 435	1,213 / 491	2,580 / 1,044
Housing Area[3]	330 / 134	290 / 117	510 / 206	115 / 47	510 / 206	
Offsite Utilities[4, 5]	30 / 12	42/ 17	21 / 8	90 / 36	48 / 19	188 / 76
Utilities - Electric and Water Lines	107 / 43	81 / 33	117 / 47	86 / 35	105 /42	not reported
Utilities - Water Well Area	45 / 18	45 / 18	45 / 18	45 / 18	45 / 18	not reported
School Expansion/ Construction	17 / 7	17 / 7	28 / 11	17 / 7	28 / 11	0/0
Total Area	**1,694 / 686**	**1,666 / 674**	**2,030 / 817**	**1,427 / 557**	**1,949 / 789**	**2,768 / 1,120**

Notes: [1]As defined by the Alternative 2 selected in the 2010 ROD. Cantonment and Housing Area acreages are combined for the No-Action Alternative.

[2]The size of the impacted area for constructing housing under either is larger than for other alternatives because of the need to replace 912 existing family housing units in addition to new units for relocating Marines.

[3]The differences in cantonment acreage between Alternatives A, B, and E are due to differences in utility configuration.

[4]Not including IT/COMM lines between specific combinations of a cantonment/family housing alternative and an LFTRC alternative, which are described in Section 2.6. Assumes a worst-case corridor of potential impact for underground utility lines whose precise location has not yet been determined. Actual area of impact along the underground lines is likely to be much less than acreages estimated here.

[5]Acreage of off-site utilities were not reported in the 2010 Final EIS; however, for purposes of this comparison, it is conservatively assumed that the acreage for the No-Action Alternative would be the same as the SEIS alternatives.

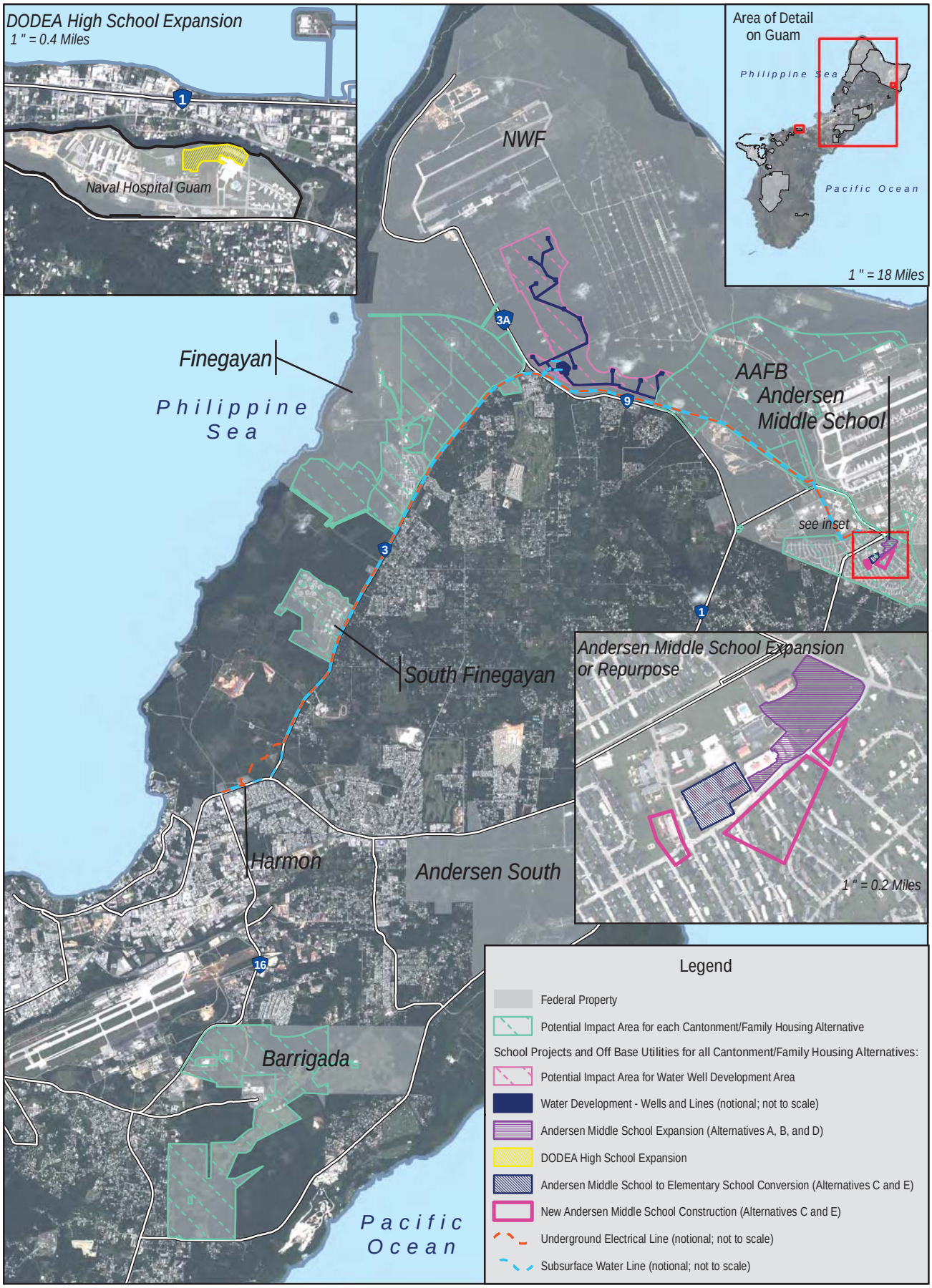


Figure 2.4-14
Proposed School Projects and Off-Site Utilities
Common to All Cantonment/Family Housing Alternatives

Source: NAVFAC Pacific 2013

2.5 LIVE-FIRE TRAINING RANGE COMPLEX ALTERNATIVES

2.5.1 Preliminary Alternatives for Live-Fire Training Range Complex

The 2010 ROD deferred a decision on the specific site for a LFTRC. In the months following issuance of the ROD, the DON formally committed that if the Route 15 area was selected for the LFTRC, the DON would provide for continual access (24 hours a day, 7 days a week) to Pågat Village and Pågat Cave historical sites, to include the existing trail from Route 15 leading to both (DoD 2011; DON 2011). The DON, to meet this commitment, applied the probabilistic methodology to determine the size of the SDZ associated with the MPMG Range. Application of this method reduced the size of the SDZ. The DON then reviewed previous LFTRC alternatives that had been considered and eliminated in the 2010 Final EIS to determine if any of those sites could be considered a reasonable alternative following application of the probabilistic methodology for a site-specific range SDZ layout. As a result of this review, the DON identified five preliminary alternatives for the range complex: two adjacent to Route 15 in northeastern Guam, and three located at or immediately adjacent to the NAVMAG area.

Comments received during scoping for the LFTRC SEIS (February-April 2012) suggested that the DON should also consider NWF at AAFB as an alternative location for the LFTRC. Although the DON had previously analyzed and dismissed NWF as a potential LFTRC alternative primarily due to operational conflicts, the DON worked with the Air Force to develop a NWF LFTRC alternative. The proposed NWF alternative does not eliminate all operational and environmental challenges; however, as presented in the SEIS it is a reasonable alternative based on the screening criteria defined for the LFTRC. In addition, because cantonment/family housing alternatives other than Finegayan are now being considered (see Section 2.4), a potential LFTRC alternative at Finegayan was also developed that merited further consideration.

As a result, the DON announced in the October 2012 NOI for this SEIS that seven LFTRC preliminary alternatives were being considered: Route 15A (Section 2.5.2.1), Route 15B (Section 2.5.2.2), NAVMAG (East/West) (Section 2.5.2.3), NAVMAG (North/South) (Section 2.5.2.4), NAVMAG (L-Shaped) (Section 2.5.2.5), NWF (Section 2.5.2.6), and Finegayan (Section 2.5.2.7).

2.5.2 Evaluation of Preliminary Alternatives for Live-Fire Training Range Complex

The DON applied the LFTRC screening criteria introduced in Section 2.3.4 to evaluate the seven preliminary LFTRC site alternatives in an effort to identify the alternatives that should be carried forward for analysis in this SEIS. The set of evaluated sites included:

- Route 15A
- Route 15B
- NAVMAG (East/West)
- NAVMAG (North/South)
- NAVMAG (L-Shaped)
- NWF
- Finegayan

The initial screening criterion for the LFTRC is the availability of sufficient area, including land, sea, and airspace to conduct the training mission of the LFTRC. There is no precise land acreage requirement for the LFTRC because the footprint would be dependent on specific site conditions. The affected areas include the space for the range facilities (including firing points, berms, and impacted areas) and

associated SDZs. The quantity and quality of land that would need to be acquired and the current ownership of such land were also considered in the evaluation. For example, any grading or other earthwork required during facility construction at any of the alternative sites would be implemented to balance cut and fill on-site to the extent possible. If off-site fill material were needed, it would be obtained from a permitted source.

The availability of land for the LFTRC preliminary alternatives involves areas encumbered by SDZs, as there would be a requirement to coordinate and control access to areas (on and off-shore) under the SDZ. In locations where the DoD owns the shoreline, the Defensive Sea Area that extends up to 3.0 nautical miles (5.5 km) offshore is also controlled by the DoD.

In the October 2012 NOI, the DON advised the public that preliminary LFTRC alternatives could evolve as the Department considered public and regulatory agency input through the NEPA process, specifically noting as an example that coordination with the FAA was ongoing in an effort "to determine whether airspace impacts would render an otherwise preliminary [LFTRC] alternative untenable." The DON further advised, "Should the FAA conclude that an alternative's conflicts with existing airspace are unmitigable, that preliminary [LFTRC] alternative would not be carried forward for evaluation in the SEIS" (77 FR 61746, October 11, 2012). As a result of interagency coordination, in January 2013 the FAA provided the DON with a feasibility assessment of each LFTRC preliminary alternative to assist the DON in identifying which alternatives would be carried forward for further analysis in this SEIS. The FAA's feasibility assessment concluded that each LFTRC preliminary alternative would result in some impact to aviation. The Naval Flight Information Group (NAVFIG), which manages DON Terminal Instrument Procedures (i.e., the requirements and standards for instrumented approaches at an airport), reviewed and concurred with the FAA's feasibility assessment. In response to the FAA's assessment and NAVFIG's concurrence, DON airspace/air traffic control (ATC) experts undertook a subsequent analysis which focused on both quantifiable airspace/ATC impacts (e.g., frequency and severity) associated with each LFTRC preliminary alternative and corresponding operational impacts to the proposed range operations and training. The results of that analysis are discussed below in the Initial Screening Criteria for each of the seven preliminary LFTRC alternatives. The FAA and NAVFIG feasibility assessment focused on commercial/general aviation and Guam International Airport operations. A subsequent Air Force (36 WG/CC) analysis revealed potential conflicts with local AAFB flight operations.

The following subsections summarize the evaluation of the seven preliminary LFTRC site alternatives that were presented during scoping, based on the screening criteria defined in Section 2.3.4. After each screening criteria was applied, a determination was made about whether or not each criterion was met (for Initial Screening Criteria) and if the conditions represented a strength or a weakness (for Additional Screening Criteria), as defined in Section 2.3.4.

2.5.2.1 Route 15A

Initial Screening Criterion

Sufficient Area (Land, Sea, and Airspace). Approximately 211 acres (85 ha) of federal land at Andersen South would be utilized and approximately 896 acres (362.6 ha) of non-federal land would need to be acquired to support the Route 15A LFTRC alternative. The SDZs would extend over GovGuam-controlled submerged lands. The SDZ for the MPMG Range was based on the probabilistic SDZ methodology which, when aggregated with the other range layout SDZs, would permit unrestricted access to the Pågat Cave and Pågat Village historical sites and the trail leading to both.

The vertical hazard associated with the Route 15A preliminary alternative would extend approximately 2,965 feet (904 m) above ground level (AGL). The FAA concluded that the number or complexity of changes associated with this LFTRC alternative would be a significant burden to controllers, aviation managers, and local airspace users, making it necessary to mitigate these impacts. Furthermore, new instrument approach or control procedures would likely be required.

DON airspace/ATC experts concluded that the Route 15A LFTRC conflicts with existing airspace, although substantial, could be mitigated. Potential mitigation measures could include adjusting flight tracks, modifying operating procedures, improving communications and/or adopting slight modification to LFTRC operations. *(Meets Criterion)*

Additional Screening Criteria

Land Acquisition Required. Acquisition of approximately 791 acres (320 ha) of GovGuam land would be required. *(Weakness)*

Proximity of Ranges to Each Other. The proposed range layout would provide ease of access for Marine Corps personnel going from range to range, including the training complex at Andersen South. *(Strength)*

Proximity of Ranges to Cantonment. The Route 15A site is located relatively close to the proposed cantonment alternatives at Barrigada (Alternative D) and AAFB (Alternative C), and is in the same general region of Guam as the two cantonment/family housing alternatives in the Finegayan area (Alternatives A and B). *(Strength)*

Mission Impacts: There are no current DoD missions at the prospective Route 15A site, so no mission impacts are anticipated. *(Strength)*

Impacts to DoD Infrastructure: The Route 15A site would have no impacts on existing DoD infrastructure. However, Route 15A would need to be relocated to accommodate the range layouts and would encroach on the existing federal land at Andersen South. *(Weakness)*

Conclusion: Route 15A is a feasible alternative for the proposed LFTRC because it has sufficient land area and airspace (assuming potential mitigation measures for airspace impacts), allows for a contiguous LFTRC footprint, and is in proximity to all cantonment alternatives. The proposed range layout would accommodate unrestricted civilian access to the Pågat Cave and Pågat Village historical sites and the trail leading to both.

2.5.2.2 Route 15B

Initial Screening Criterion

Sufficient Area (Land, Sea, and Airspace). Approximately 1,227 acres (497 ha) of non-federal land would need to be acquired to support the Route 15B LFTRC alternative, including Marbo Cave and the surrounding area. SDZs would extend over GovGuam-controlled submerged lands. The proposed SDZs would encroach on the Class D regulated airspace associated with the Guam International Airport (also known as the Won Pat International Airport). The range layout would permit unrestricted access to the Pågat Cave, Pågat Village, and the existing trail leading to both.

The vertical hazard associated with this alternative would extend 2,965 feet (904 m) AGL. The FAA's feasibility assessment determined that the LFTRC preliminary alternative at Route 15B would impact arrivals into and departures out of the Guam International Airport, noting that the impact was driven by the direct proximity of the preliminary alternative to established instrumented approaches, missed approach procedures, and known daily flight paths of civil aircraft. Further, the FAA emphasized that the

Route 15B preliminary alternative was located within Class D airspace. Class D airspace is generally cylindrical in form and normally extends from the surface to 2,500 feet (760 m) above the ground. All traffic inside Class D airspace is controlled by ATC and specifically the Airport Control Tower.

The DON's follow-on airspace/ATC analysis concluded that airspace/ATC impacts associated with the Route 15B preliminary alternative could not be mitigated.

Conclusion: For the reasons noted above, the DON determined that the Route 15B LFTRC preliminary alternative does not satisfy the initial screening criterion associated with sufficient airspace. The Route 15B preliminary LFTRC alternative is not carried forward for further evaluation in this SEIS.

The DON recognizes that not carrying forward the Route 15B preliminary alternative presents an apparent inconsistency with the 2010 Final EIS, which identified a Route 15B LFTRC alternative as a reasonable option to meet Marine Corps live-fire training requirements. During the development of this SEIS, the DON worked with the FAA to determine whether airspace/ATC impacts would render an otherwise acceptable preliminary alternative untenable. While the DON did not request a feasibility assessment from the FAA as part of the 2009 Draft EIS or the 2010 Final EIS, it did note in the 2010 Final EIS the potential airspace/ATC conflicts associated with this location. The 2010 Final EIS further identified that additional discussions with FAA would be required prior to the DON submitting any proposal for restricted airspace associated with the Route 15B alternative. A Restricted Area is a type of Special Use Airspace (SUA) within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Formal discussions with the FAA following the 2010 ROD occurred after the DON's decision to defer a final decision on the location of the LFTRC. These discussions resulted in the DON determining that the Route 15B alternative has significant airspace/ATC impediments that cannot be mitigated without unacceptable modifications to the proposed training action. This resulted in the DON concluding that this alternative is no longer reasonable.

2.5.2.3 Naval Magazine (East/West)

Initial Screening Criterion

Sufficient Area (Land, Sea, and Airspace). The NAVMAG (East/West) LFTRC would require the use of portions of the NAVMAG and the acquisition of approximately 1,894 acres (766 ha) of non-federal land. The SDZs would be contained within the newly acquired lands and the NAVMAG boundary.

The vertical hazard associated with this preliminary alternative would extend 2,965 feet (904 m) AGL. The January 2013 FAA feasibility assessment of each LFTRC preliminary alternative determined that the NAVMAG (East/West) alternative would be a significant burden to controllers, aviation managers, and local airspace users making it necessary to mitigate these impacts. Furthermore, new instrument approach or control procedures would likely be required.

The DON's follow-on airspace/ATC analysis concluded that the NAVMAG (East/West) preliminary LFTRC alternative's conflicts with existing airspace, although substantial, could be mitigated. Potential mitigation measures could include adjusting flight tracks, modifying operating procedures, improving communications and/or adopting slight modification to LFTRC operations. *(Meets Criterion)*

Additional Screening Criteria

Land Acquisition. This preliminary alternative would require the acquisition of approximately 1,894 acres (766 ha) of privately owned and GovGuam lands. This alternative would require the most land acquisition. *(Weakness)*

Proximity of Ranges to Each Other. The proposed range layout would provide ease of access for Marine Corps personnel going from range to range, so this consideration represents a strength for the NAVMAG (East/West) preliminary alternative. *(Strength)*

Proximity of Ranges to Cantonment. The NAVMAG (East/West) LFTRC site is not located in the same region of Guam as any of the cantonment/family housing alternatives that have been carried forward and would require travel along congested roadways. *(Weakness)*

Mission Impacts: The NAVMAG (East/West) site would not impact the munitions magazines or other operations on the NAVMAG so there is no impact on existing DoD missions. *(Strength)*

Impacts to DoD Infrastructure: There would be no impact on DoD infrastructure *(Strength)*; however, new road access would need to be constructed on private land to the NAVMAG (East/West) LFTRC site.

Conclusion: The NAVMAG (East/West) site is a feasible alternative because sufficient land area could be made available (through a combination of existing DoD land and acquired land) and sufficient airspace would also be available (assuming potential mitigation measures for airspace impacts). In addition, the site has relatively flat topography, and is in a relatively undeveloped area of Guam. This alternative would require the largest amount of land acquisition of the three NAVMAG site alternatives.

2.5.2.4 Naval Magazine (North/South)

Initial Screening Criterion

Sufficient Area (Land, Sea, and Airspace). The NAVMAG (North/South) preliminary alternative would require the use of NAVMAG and the acquisition of approximately 252 acres (102 ha) of non-federal land to support the proposed LFTRC. The SDZs would be contained within the newly acquired lands and the NAVMAG boundary.

The vertical hazard associated with this preliminary alternative would extend 2,965 feet (904 m) AGL. The January 2013 FAA feasibility assessment of each LFTRC preliminary alternative determined that the NAVMAG (North/South) alternative would be a significant burden to controllers, aviation managers, and local airspace users making it necessary to mitigate these impacts. Furthermore, new instrument approach or control procedures would likely be required.

The DON's follow-on airspace/ATC analysis concluded that the NAVMAG (North/South) LFTRC alternative's conflicts with existing airspace, although substantial, could be mitigated. Potential mitigation measures could include adjusting flight tracks, modifying operating procedures, improving communications and/or adopting slight modification to LFTRC operations. *(Meets Criterion)*

Additional Screening Criteria

Land Acquisition. Approximately 252 acres (102 ha) of non-federal land would be required. *(Weakness)*

Proximity of Ranges to Each Other. The proposed range layout would provide ease of access for Marine Corps personnel going from range to range so this consideration represents a strength for the NAVMAG (North/South) site alternative. *(Strength)*

Proximity of Ranges to Cantonment. The NAVMAG North/South LFTRC site is not located in the same region of Guam as any of the cantonment/family housing alternatives and would require travel along congested roadways. *(Weakness)*

Mission Impacts: The NAVMAG (North/South) site would require relocation of existing munitions storage magazines and concurrence would be needed from the tenant (Naval Munitions Command) on

how this would be accomplished. Relocation sites would have to be approved and any impacts related to the timing of range construction relative to magazine construction would need to be addressed. This alternative would also encumber the following existing facilities: breacher house, sniper range, and the Ordnance Annex Detonation Range. In addition to existing uses, the NAVMAG (North/South) Alternative would encumber a Landing Zone and 1,630 acres (660 ha) of the Non-Firing Maneuver area approved in the ROD for the 2010 Final EIS. *(Weakness)*

Impacts to DoD Infrastructure: In the long-term, no impacts to DoD infrastructure are envisioned as all existing ordnance assets that would be impacted by the proposed ranges would be relocated and there would be no direct impacts to Fena Reservoir. However, in the short term, relocation site plans would need to be prepared and would need to meet current DoD explosives safety siting criteria. *(Weakness)*

Conclusion: The NAVMAG (North/South) site is a feasible alternative because sufficient land area could be made available (through a combination of existing DoD land and acquired land) and sufficient airspace may be available (assuming potential mitigation measures for airspace impacts). However, it would impact existing ordnance storage facilities and functions at the NAVMAG and construction would require considerable additional costs and take additional time to relocate the impacted facilities. Grading requirements and costs are expected to be significant due to the existing steep topography. Another relative weakness of the site is the lack of close proximity to the cantonment alternatives (of which Barrigada Alternative D is the closest).

2.5.2.5 Naval Magazine (L-Shaped)

Initial Screening Criterion

Sufficient Area (Land, Sea, and Airspace). The NAVMAG (L-Shaped) LFTRC alternative would require the use of portions of the NAVMAG and the acquisition of approximately 914 acres (370 ha) of non-federal land. The SDZs would be contained within the newly acquired lands and the NAVMAG boundary.

The vertical hazard associated with this preliminary alternative would extend 2,965 feet (904 m) AGL. The January 2013 FAA feasibility assessment of each LFTRC preliminary alternative determined that the NAVMAG (L-Shaped) alternative would be a significant burden to controllers, aviation managers, and local airspace users, making it necessary to mitigate these impacts. Furthermore, new instrument approach or control procedures would likely be required.

The DON's follow-on airspace/ATC analysis concluded that the NAVMAG (L-Shaped) LFTRC alternative's conflicts with existing airspace, although substantial, could be mitigated. Potential mitigation measures could include adjusting flight tracks, modifying operating procedures, improving communications and/or adopting slight modification to LFTRC operations. *(Meets Criterion)*

Additional Screening Criteria

Land Acquisition. Approximately 914 acres (370 ha) of privately-owned and GovGuam lands would be required. *(Weakness)*

Proximity of Ranges to Each Other. Acceptable, but the range facilities would be dispersed over a wide area and would not support walking from one range site to the other. Additionally, a new access road would need to be constructed to provide access to all but the MPMG Range. This is one of the weak points of this alternative from an operational perspective. *(Weakness)*

Proximity of Ranges to Cantonment. The NAVMAG (L-Shaped) LFTRC site is not located in the same region of Guam as any of the cantonment/family housing alternatives and would require travel along congested roadways. *(Weakness)*

Mission Impacts: The NAVMAG (L-Shaped) site would require relocation of existing munitions storage magazines and concurrence would be needed from the tenant (Naval Munitions Command) on how this would be accomplished. Relocation sites would have to be approved and any impacts related to the timing of range construction relative to magazine construction would need to be addressed. This alternative would also encumber the following existing facilities: breacher house, sniper range, and the Ordnance Annex Detonation Range. In addition to existing uses, the NAVMAG (North/South) Alternative would encumber the two Landing Zones and 2,303 acres (932 ha) of the Non-Firing Maneuver area approved in the ROD for the 2010 Final EIS. *(Weakness)*

Impacts to DoD Infrastructure: In the long-term, no impacts to DoD infrastructure are envisioned as all existing ordnance assets that would be impacted by the proposed ranges would be relocated. However, in the short term, relocation site plans would need to be prepared and would need to meet current DoD explosives safety siting criteria. Short-term impacts to DoD munitions storage and handling would be anticipated. *(Weakness)*

Conclusion: The DON considers the NAVMAG (L-Shaped) site to be a feasible alternative because sufficient land area could be made available (through a combination of existing DoD land and acquired land) and sufficient airspace would also be available (assuming potential mitigation measures for airspace impacts). However, this site would spread the LFTRC over a wide area, likely requiring transportation support if the training units needed to use more than one portion of the range complex. Additionally, a new access road would be required to access the east/west oriented ranges. The NAVMAG (L-Shaped) site would impact existing ordnance storage facilities and functions at the NAVMAG and would require additional costs and take additional time to relocate the impacted facilities. Grading requirements and costs are expected to be considerable due to the existing steep topography. Another relative weakness of the site is the lack of close proximity to the cantonment alternatives (of which Barrigada Alternative D is the closest).

2.5.2.6 Northwest Field

Initial Screening Criterion

Sufficient Area (Land, Sea, and Airspace). All range areas and range support facilities for the NWF LFTRC preliminary alternative would be located on existing DoD owned land at NWF. The range SDZs would overlie approximately 142 acres (57 ha) of the Ritidian Unit of the Guam NWR, managed by the USFWS, and over federally owned submerged lands along the shoreline at Ritidian Point. No privately owned lands would be encumbered by this alternative.

The vertical hazard associated with this preliminary alternative could extend up to 2,965 feet (904 m) AGL. The exact configuration of the SUA is subject to ongoing actions between DoD and the FAA. The January 2013 FAA feasibility assessment of each LFTRC preliminary alternative determined that airspace procedural adjustments would be within achievable limits based upon the amount and type of changes required in addition to impacts on air traffic volume and flight patterns. However, this assessment did not consider impacts to the AAFB mission or airspace. The DON's analysis of the FAA assessment concluded that the NWF LFTRC alternative's conflicts with existing airspace were the least of any of the LFTRC alternatives and could be easily mitigated. Potential measures could include adjusting flight

tracks, modifying operating procedures, improving communications and/or adopting slight modification to LFTRC operations. *(Meets Criterion)*

Additional Screening Criteria

Land Acquisition. No requirement for acquisition of lands. *(Strength)*

Proximity of Ranges to Each Other. This consideration represents a strength for the NWF site alternative. The proposed range layout would provide ease of access for Marine Corps personnel going from range to range. *(Strength)*

Proximity of Ranges to Cantonment. The NWF site is located in very close proximity to the proposed cantonment alternatives in the Finegayan area (Alternatives A and B) and at AAFB (Alternative C). The site is located in the same general region of Guam as the cantonment/family housing alternative at Barrigada (Alternative D). *(Strength)*

Mission Impacts: The Air Force identified potential mission impacts including the potential relocation of the Joint Threat Emitter, airspace impacts around the active runways at AAFB, the expeditionary runway at NWF, and the U.S. Pacific Air Forces Regional Training Center complex. *(Weakness)*

Impacts to DoD Infrastructure: New roads would be required to connect the LFTRC facilities to the existing road network and the current communication infrastructure may require relocation. However, these potential impacts are considered minimal. *(Weakness)*

Conclusion: The DON considers the NWF site to be a feasible alternative because it provides a compact LFTRC development and does not require any land acquisition. It is anticipated that potential impacts to the Air Force mission can be resolved or deconflicted.

2.5.2.7 Finegayan

Initial Screening Criterion

Sufficient Area (Land, Sea, and Airspace). All range areas and range support facilities would be located on existing DoD land at Finegayan. SDZs would extend over GovGuam controlled submerged lands. No privately-owned lands would be encumbered by this alternative.

The vertical hazard associated with this alternative would extend 2,965 feet (904 m) AGL. The FAA's feasibility assessment determined that the LFTRC preliminary alternative at Finegayan would impact arrivals into and departures out of the Guam International Airport and AAFB, and these impacts cannot be mitigated. The FAA's feasibility assessment concluded that this preliminary alternative was not feasible. The DON's follow-on airspace/ATC analysis concluded that airspace/ATC impacts associated with the Finegayan LFTRC alternative could not be mitigated. *(Does Not Meet Criterion)*

Conclusion: For the reasons noted above, the DON determined that the Finegayan LFTRC is not a feasible alternative because it does not satisfy the initial screening criterion associated with sufficient airspace. Accordingly, evaluation of additional screening criteria is not applicable. The Finegayan LFTRC preliminary alternative is not carried forward for further evaluation in this SEIS.

2.5.3 Preliminary Alternatives Considered but Eliminated from Further Analysis

Table 2.5-1 summarizes the results of the alternatives screening criteria evaluation for each of the preliminary LFTRC alternatives discussed in Section 2.5.2. The Route 15B (Section 2.5.2.2) and Finegayan (Section 2.5.2.7) preliminary alternatives were considered but eliminated from further analysis in this SEIS.

Table 2.5-1. Results of Preliminary Alternative Evaluation for LFTRC

	Route 15A	***Route 15B***	***NAVMAG (East/West)***	***NAVMAG (North/South)***	***NAVMAG (L-Shaped)***	***NWF***	***Finegayan***
Initial Screening Criterion							
Sufficient Land, Sea, and Airspace	Meets Criterion	Does Not Meet Criterion	Meets Criterion	Meets Criterion	Meets Criterion	Meets Criterion	Does Not Meet Criterion
Additional Screening Criteria							
Land Acquisition	Weakness	NA	Weakness	Weakness	Weakness	Strength	NA
Proximity of Ranges to Each Other	Strength	NA	Strength	Strength	Weakness	Strength	NA
Proximity of Ranges to Cantonment	Strength	NA	Weakness	Weakness	Weakness	Strength	NA
Mission Impacts	Strength	NA	Strength	Weakness	Weakness	Weakness	NA
Infrastructure Impacts	Weakness	NA	Strength	Weakness	Weakness	Weakness	NA
Conclusion	***Carried Forward***	***Not Carried Forward***	***Carried Forward***	***Carried Forward***	***Carried Forward***	***Carried Forward***	***Not Carried Forward***

Note: NA = not applicable

2.5.4 Preliminary Alternatives Carried Forward for Analysis: Live-Fire Training Range Complex

The evaluation of preliminary alternatives described above determined that five LFTRC alternatives are sufficiently aligned with the screening criteria and the Marine Corps Guiding Principles to be carried forward for impacts analysis in this SEIS. Figure 2.5-1 shows the locations of all five LFTRC alternatives on Guam:

- Route 15 (Alternative 1)
- NAVMAG (East/West) (Alternative 2)
- NAVMAG (North/South) (Alternative 3)
- NAVMAG (L-Shaped) (Alternative 4)
- NWF (Alternative 5)

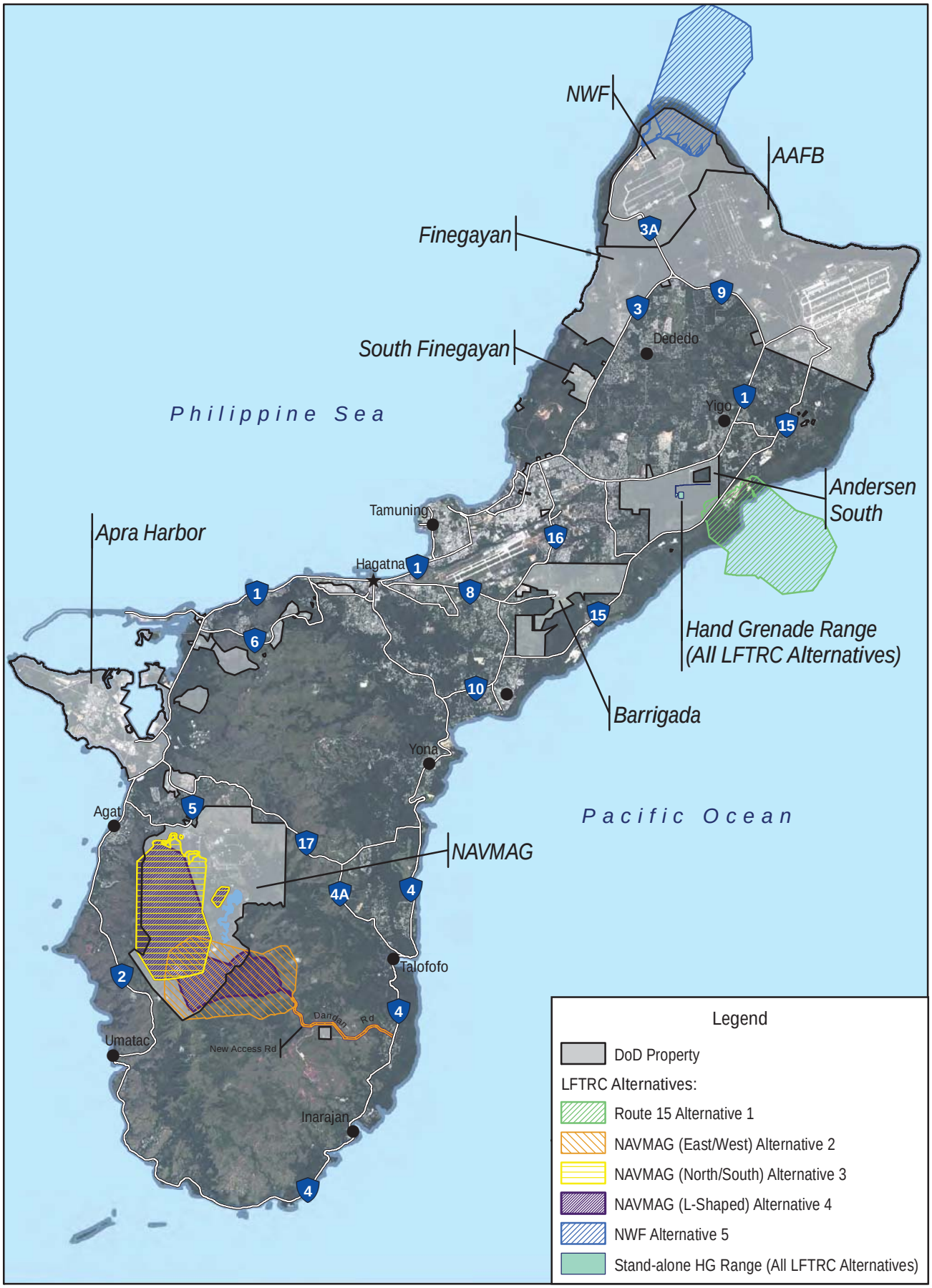


Figure 2.5-1
LFTRC Alternatives
Carried Forward for Analysis

All LFTRC alternatives would include the MPMG Range, MRF Range, KD Pistol Range, KD Rifle Range, Non-standard Small Arms Range, range maintenance building, and a range administration building. The HG Range for all LFTRC alternatives would be located at Andersen South. Details about the individual ranges have been provided in Section 2.2.2. As described in Section 2.1, a No-Action Alternative was also carried forward for analysis in this SEIS, although such an alternative would not meet the purpose of and need for the proposed action and would not be consistent with the new force posture adopted by the DoD in the 2012 Roadmap Adjustments.

Each of the five LFTRC alternatives would require the establishment of SUA overlaying the firing ranges because of the vertical ricochet hazard associated with the proposed live-fire training. Established by the FAA, SUA is designed to alert users about areas of military activity, unusual flight hazards, or national security needs, and to segregate that activity from other airspace users to enhance safety. A type of SUA that would pertain to the proposed LFTRC is a Restricted Area. A Restricted Area is identified as an area within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Restricted Areas denote the existence of unusual hazards to aircraft such as artillery firing, aerial gunnery, small arms fire, or guided missiles. In addition, the proposed HG Range at Andersen South common to all LFTRC alternatives would include a Controlled Firing Area (CFA), which is airspace designated to contain activities that if not conducted in a controlled environment could be hazardous to other aircraft in the area. CFAs provide a means to accommodate certain hazardous activities (such as live-fire HG employment) that can be immediately suspended in the event that a nonparticipating aircraft approaches the area. The proposed SUA and CFA for each of the five LFTRC alternatives is described in detail in the relevant Airspace sections of Chapter 5 (e.g., Section 5.1.5 for Alternative 1, Section 5.2.5 for Alternative 2).

2.5.4.1 Route 15 Live-Fire Training Range Complex - Alternative 1

The Route 15 LFTRC Alternative 1 (Figure 2.5-2) would consist of approximately 3,762 acres (1,522 ha) (not including the stand-alone HG Range at Andersen South) and would require federal land acquisition of an estimated 872 acres (353 ha) of Chamorro Land Trust Commission, Guam Ancestral Lands Commission (GALC), and GovGuam lands. Direct physical disturbance would potentially occur on approximately 383 acres (155 ha) of this site for the construction of the individual ranges, range support building, parking areas, range towers, internal range access roads, a perimeter fence, and the realignment location of Route 15. Approximately 3,379 acres (1,367 ha) would include lands and submerged lands within the SDZ that would not be directly impacted as a result of construction or operation of the LFTRC. This includes approximately 574 acres (232 ha) of GovGuam land and 2,805 acres (1,135 ha) of the submerged lands of the Pacific Ocean. Grading requirements for Alternative 1 LFTRC construction would include 2,488,676 yd^3 (1,902,730 m^3) of cut and 2,451,937 yd^3 (1,874,640 m^3) of fill, resulting in a net total of 36,740 yd^3 (28,090 m^3) of cut material available for use as needed.

Alternative 1 would be located in a single location adjacent to Andersen South. Access to the ranges would be via Route 1 through the existing Andersen South entry control point. An underpass under the relocated Route 15 would allow access to the internal range road network. Alternate access would be via a second underpass under the Route 15 bypass from the Andersen South Military Operations in Urban Terrain facility.

Utilities

Due to the numerous permutations for IT/COMM, this utility is covered for all LFTRC alternatives and permutations between cantonment/family housing and LFTRC alternatives in Section 2.6.

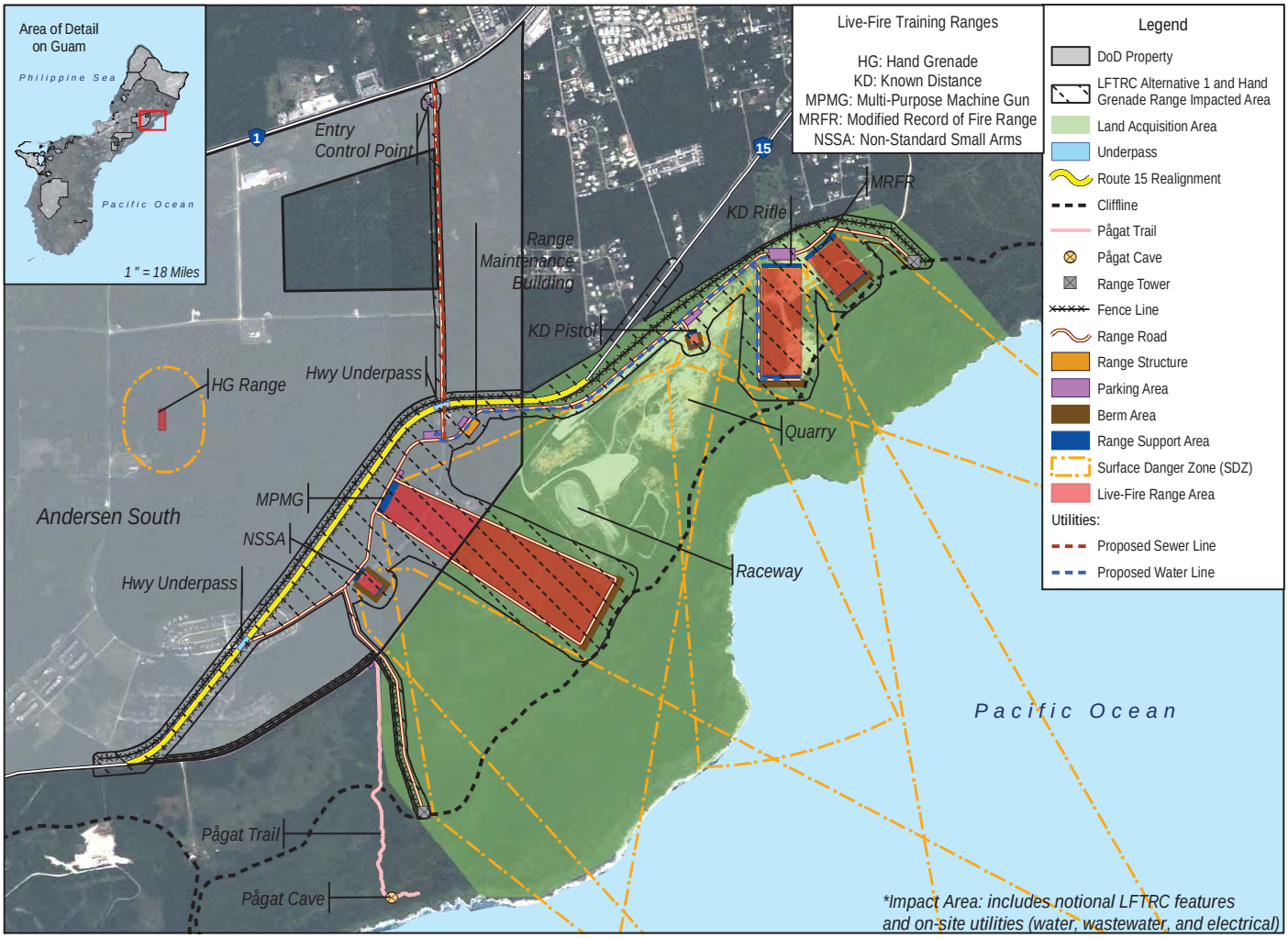


Figure 2.5-2
Proposed Route 15 LFTRC Alternative 1

Electrical Power

Power to the Alternative 1 would be from the existing 13.8 kV line from Marbo Substation near Pump Station No. 3 and Route 15. An alternative source of power could be utilized from the existing GPA-owned 13.8 kV overhead line on concrete poles, which originates from the north on Route 15 and serves the Guam International Raceway. This existing 13.8 kV line would require modification to serve the ranges. The realignment of Route 15 would require the modification of the existing single phase 13.8 kV line that feeds the existing buildings south of Route 15 to maintain the proper circuit to the existing buildings. Underground distribution lines in concrete encased conduit duct banks would be installed to the various ranges and facilities requiring electrical power along the range access roadways and within the range footprints. Pad mounted distribution transformers would be provided as needed.

Potable Water

Potable water service is only required for the range maintenance building and KD Pistol/KD Rifle Range administration buildings. Alternative 1 would include construction of a new water line that would connect to the existing water line on Turner Street near the existing Marbo Booster Pump Station No. 3. A fire hydrant or stand pipe would be installed to facilitate filling range firefighting vehicles. The new potable water distribution pipes would be installed underground at least 3.0 feet (0.9 m) deep. The width of the trench to install the pipes would be about 1.5 feet (0.5 m) to 2.0 feet (0.6 m) for 6 inch (15 cm) to 12 inch (30 cm) pipes. Larger excavations would be required for the installation of manholes.

Wastewater

The range maintenance and KD Pistol/KD Rifle Range administration buildings would require sewer service. The new wastewater collection system for Alternative 1 would include new gravity main approximately 4,920-feet (1,500-m) long and manholes to tie into the existing GWA wastewater collection system at a manhole along Route 1. Wastewater would be conveyed to the Northern District WWTP for treatment and disposal.

The new wastewater collection system would be installed underground with a minimum 3.0-feet (0.9-m) cover to approximately 5.0 feet (1.5 m) deep, or sometimes deeper if needed. The width of the installation trench would be approximately 2.0 feet (0.6 m) to 3.0 feet (0.9 m) wide. Larger excavations would be required for the installation of manholes. Ranges would be provided with portable toilets requiring periodic servicing. For purposes of this SEIS, it is assumed that the wastewater from the portable toilets would be collected and taken to the Northern District WWTP for treatment and disposal. Upgrades to the Northern District WWTP are already needed in order for the plant to achieve compliance with the current NPDES permit.

Solid Waste

Solid waste generation at the ranges is expected to be minimal during operation. Collection bins would be provided at appropriate locations and periodically emptied, with solid waste taken to the most convenient transfer station or recycling center for processing and transfer to the appropriate disposal or recycling facility. Construction and demolition debris would be processed for reuse or disposed in existing disposal facilities in accordance with all regulatory requirements, EOs, and DoD requirements.

2.5.4.2 Naval Magazine (East/West) Live-Fire Training Range Complex - Alternative 2

The NAVMAG (East/West) LFTRC Alternative 2 (Figure 2.5-3) would consist of approximately 3,815 acres (1,544 ha) (not including the HG Range at Andersen South), and would require acquisition of approximately 1,894 acres (766 ha) of privately-owned and GovGuam land. Direct physical disturbance would occur on approximately 382 acres (154 ha), including 275 acres (111 ha) for the construction of the individual ranges, range support building, internal range access roads, and a perimeter fence, plus approximately 107 acres (43 ha) to construct an external LFTRC access road from Route 4 (as shown in Figure 2.5-1). The remaining approximately 3,433 acres (1,389 ha) would include 3,026 acres (1,225 ha) of lands within the SDZ and 407 acres (165 ha) of land surrounding the individual ranges that would not be directly affected by construction or operation of the LFTRC. Grading for Alternative 2 LFTRC construction would include 1,246,720 yd^3 (953,186 m^3) of cut (excavation) and 1,254,698 yd^3 (959,286 m^3) of fill, with a net requirement of 7,981 yd^3 (6,102 m^3) of fill. Since grading requirements for any of the cantonment/family housing alternatives would generate a net amount of cut material in excess of the amount of fill required for LFTRC Alternative 2, it is not expected that fill material from off-island sources would be necessary to meet this fill requirement.

Alternative 2 would be located in a single location on the non-federal land to the southeast of the NAVMAG. The ranges would be oriented to the west and the composite SDZ would extend over portions of the NAVMAG. Access to the ranges would be via a new access road from Dandan Road that would be constructed with the LFTRC. Approximately 5 miles (8 km) of roads would be constructed to provide access between the individual ranges. Utility easements would be required to be obtained along existing Dandan Road for IT/COMM and along the new proposed access road for all utilities.

Utilities

Due to the numerous permutations for IT/COMM, this utility is covered for all LFTRC alternatives and permutations between cantonment/family housing and LFTRC alternatives in Section 2.6.

Electrical Power

Power to LFTRC Alternative 2 would be from the existing GPA-owned underground power line that runs along Dandan Road. New electrical lines would be installed in an underground concrete encased conduit duct bank routed along the proposed new access road to the LFTRC entry control point. Underground distribution lines in concrete encased conduit duct banks would be installed to the various ranges and facilities requiring electrical power along the range access roadways and within the range footprints. Pad mounted distribution transformers would be provided as needed.

Potable Water

Potable water service would only be required for the Range Maintenance Building and KD Pistol/KD Rifle Range Maintenance Building. A new water line would be constructed along the proposed new access road and would connect with the existing GWA water line in Dandan Road. A fire hydrant or stand pipe would be installed to facilitate filling range firefighting vehicles. The new potable water distribution pipes would be installed underground at least 3.0 feet (0.9 m) deep. The width of the trench to install the pipes would be about 1.5 feet (0.5 m) to 2.0 feet (0.6 m) for 6 inch (15 cm) to 12 inch (30 cm) pipes. Larger excavations would be required for the installation of manholes.

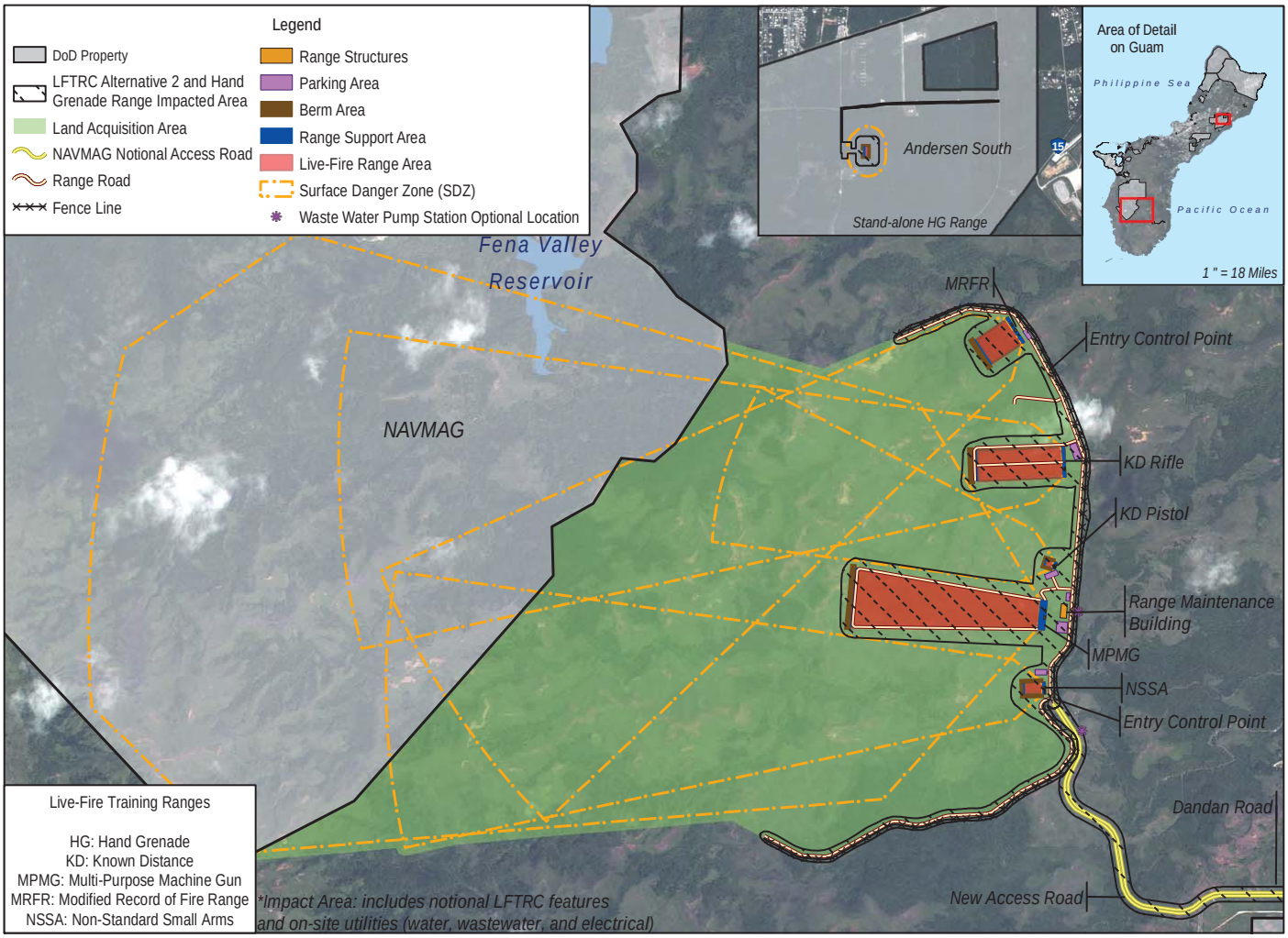


Figure 2.5-3
Proposed NAVMAG (East/West) LFTRC Alternative 2

Source: NAVFAC Pacific 2013

Wastewater

The range maintenance and KD Pistol/KD Rifle administration buildings would require sewer service. Due to the remote location of the range maintenance building, the recommended approach to wastewater collection is installation of a holding tank to store wastewater generated at the building. Periodically, the wastewater would be pumped out and is anticipated to be transferred to the Northern District WWTP for treatment and disposal where a septage handling facility is available. An optional wastewater collection system would include two gravity mains totaling 1,480 feet (451 m), manholes, two packaged WWPS, and two force mains totaling 6,300 feet (1,570 m) along the proposed new access roadway alignment, with connection to the existing GWA wastewater collection system along Dandan Road where wastewater would be conveyed to the Inarajan WWTP for treatment and disposal.

The optional wastewater collection system would be installed underground with a minimum 3.0 feet (0.9 m) cover to approximately 5.0 feet (1.5 m) deep, or sometimes deeper if needed. The width of the installation trench would be approximately 2.0 feet (0.6 m) to 3.0 feet (0.9 m) wide. Larger excavations would be required for the installation of manholes. Ranges would be provided with portable toilets requiring periodic servicing. For purposes of this SEIS, it is assumed that the wastewater from the portable toilets would be collected and taken to the Northern District or Apra Harbor WWTPs or wherever an approved septage handling facility is available for treatment and disposal.

Solid Waste

Solid waste generation at the ranges is expected to be minimal during operation. Collection bins would be provided at appropriate locations and periodically emptied, with solid waste taken to the most convenient transfer station for processing and transfer to the appropriate disposal or recycling facility. During construction, all green waste would be processed for reuse (mulch and compost). Construction and demolition debris would be processed for reuse or disposed in existing disposal facilities in accordance with all regulatory requirements, EOs, and DoD requirements.

2.5.4.3 Naval Magazine (North/South) Live-Fire Training Range Complex - Alternative 3

The NAVMAG (North/South) LFTRC Alternative 3 (Figure 2.5-4) would comprise a total of approximately 3,549 acres (1,436 ha) (not including the stand-alone HG Range at Andersen South) and would require acquisition of 252 acres (102 ha) of GovGuam and privately-owned lands. Approximately 370 acres (150 ha) would be required for construction of the proposed range facilities, while 3,179 acres (1,286 ha) would be land within the SDZ that would not be directly affected by construction or operation of the LFTRC.

The 370 acres (150 ha) that would be developed include the areas for construction of the individual ranges, range support building, range access roads, munitions magazine relocation area, and a perimeter fence along the western edge of the LFTRC. Grading requirements for construction of the ranges and associated infrastructure would include 4,932,976 yd^3 (3,771,530 m^3) of cut and 3,130,058 yd^3 (2,393,100 m^3) of fill, resulting in a net requirement of 1,802,919 yd^3 (1,378,430 m^3) of cut. An estimated 72 new concrete munitions storage magazines would be constructed (see proposed Magazine Relocation Area in Figure 2.5-4) to accommodate the transfer of munitions from the existing magazines that would be encumbered by the range SDZs. The existing magazines would be abandoned in place.

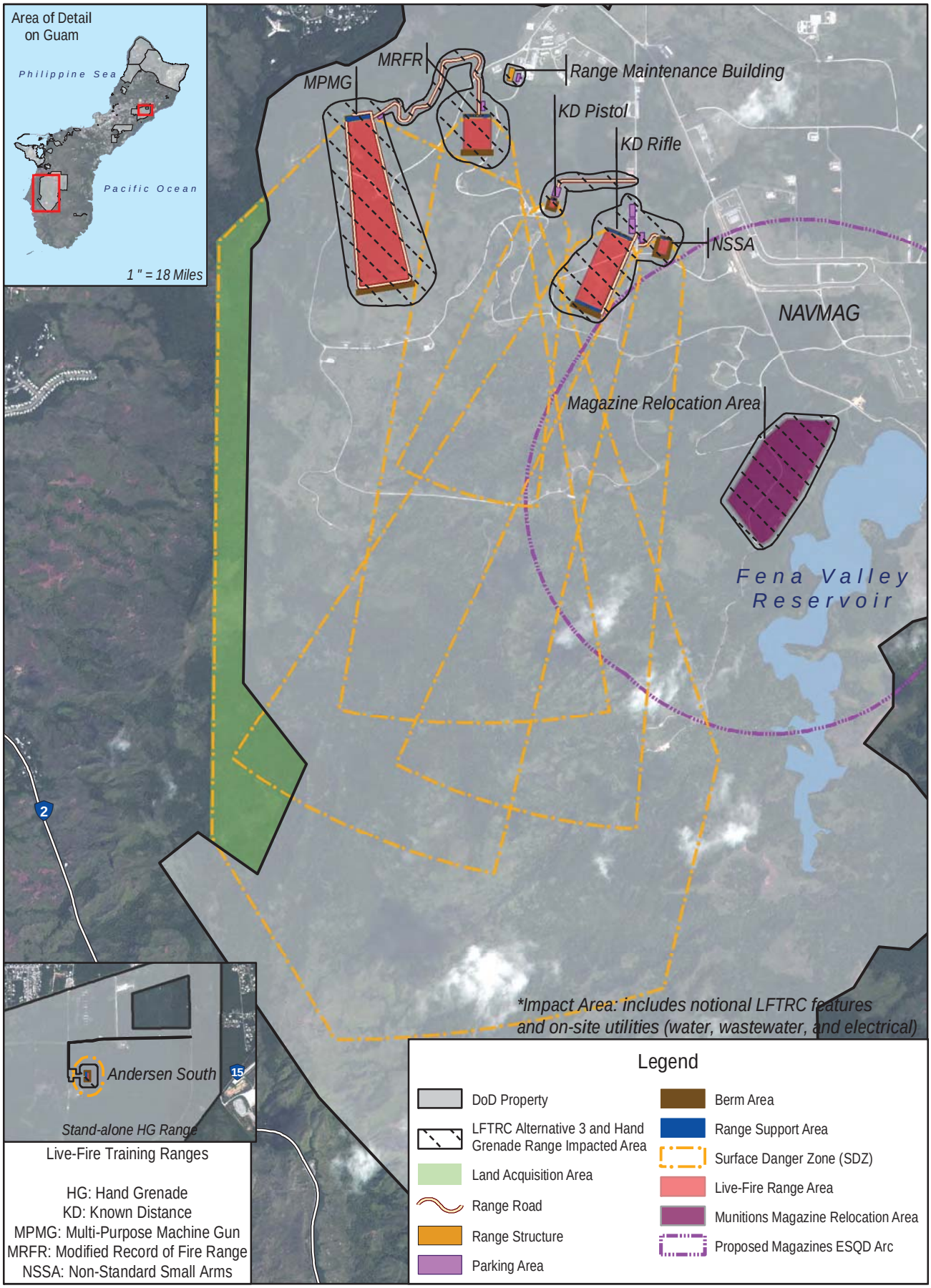


Figure 2.5-4
Proposed NAVMAG (North/South)
LFTRC Alternative 3

Ranges would be configured so that they are adjacent and accessible by Marine Corps personnel via the existing main gate on Route 5. Access between the ranges would occur through a combination of existing NAVMAG roadways and approximately 3.0 miles (4.8 km) of new roads constructed as part of the LFTRC.

Utilities

Due to the numerous permutations for IT/COMM, this utility is covered for all LFTRC alternatives and permutations between cantonment/family housing and LFTRC alternatives in Section 2.6.

Electrical Power

Power to the LFTRC would be from the existing DON-owned 13.8 kV overhead line along Blandy Road. The tap circuit would be installed underground in a concrete encased conduit bank. A 10 kVA pad-mounted transformer located near the range would transform the 13.8 kV line to 120/240 Volt power to the facilities. Power to the remaining range sites would be from the existing three-phase 13.8 kV overhead line running along Parsons Road, with pad mounted distribution transformers to provide 120/240 Volt power to the facilities.

Potable Water

Potable water service is only required for the range maintenance and KD Pistol/KD Rifle Range administration buildings. Alternative 3 would include new water lines connected to an existing water line within NAVMAG. A fire hydrant or stand pipe would be installed near each building to facilitate filling range firefighting vehicles. The new potable water distribution pipes would be installed underground at least 3.0 feet (0.9 m) deep. The width of the trench to install the pipes would be about 1.5 feet (0.5 m) to 2.0 feet (0.6 m) for 6 inch (15 cm) to 12 inch (30 cm) pipes. Larger excavations would be required for the installation of manholes.

Wastewater

The range maintenance and KD Pistol/Rifle Range administration buildings would require sewer service. Alternative 3 is in close proximity to the existing wastewater collection system in the NAVMAG area. The new wastewater collection system for Alternative 3 would include a 115 feet (35 m) long gravity main and manholes that would tie into the existing DoD wastewater collection system. Wastewater would be conveyed to the Apra Harbor WWTP for treatment and disposal.

The new wastewater collection system would be installed underground with a minimum 3.0 feet (0.9 m) cover to approximately 5.0 feet (1.5 m) deep, or sometimes deeper if needed. The width of the installation trench would be approximately 2.0 feet (0.6 m) to 3.0 feet (0.9 m) wide. Larger excavations would be required for the installation of manholes. Ranges would be provided with portable toilets requiring periodic servicing. For purposes of this SEIS, it is assumed that the wastewater from the portable toilets would be collected and taken to the Northern District or Apra Harbor WWTPs or wherever an approved septage handling facility is available for treatment and disposal. Upgrades to the Northern District WWTP are already needed in order for the plant to achieve compliance with the current NPDES permit.

Solid Waste

Solid waste generation at the ranges is expected to be minimal during operation. Collection bins would be provided at appropriate locations and periodically emptied and processed with existing solid waste being generated at the NAVMAG site. During construction, all green waste would be processed for reuse

(mulch and compost). Construction and demolition debris would be processed for reuse or disposed in existing disposal facilities in accordance with all regulatory requirements, EOs, and DoD requirements.

2.5.4.4 Naval Magazine (L-Shaped) Live-Fire Training Range Complex - Alternative 4

The NAVMAG (L-Shaped) LFTRC Alternative 4 (Figure 2.5-5) would consist of approximately 4,895 acres (1,981 ha) (not including the HG Range at Andersen South) and would require the acquisition of approximately 914 acres (370 ha) of privately-owned and GovGuam land. Direct physical ground disturbance would occur on approximately 477 acres (193 ha), which would include approximately 356 acres (144 ha) for the construction of the individual ranges, range support building, internal range access roads, munitions magazine relocation area, and a perimeter fence along the western and southern edges of the LFTRC, and approximately 121 acres (49 ha) to construct an external LFTRC access road from Route 4 to the east/west facing ranges (see Figure 2.5-1). The remaining 4,418 acres (1,788 ha) would include 4,165 acres (1,686 ha) of land within the SDZ and 253 acres (102 ha) of land surrounding the individual ranges that would not be built up. Grading requirements for Alternative 4 LFTRC construction would include 2,716,125 yd^3 (2,076,627 m^3) of cut and 2,767,463 yd^3 (2,115,878 m^3) of fill, resulting in a net requirement of 51,337 yd^3 (39,250 m^3) of fill. Since grading requirements for any of the cantonment/family housing alternatives would generate a net amount of cut material in excess of the amount of fill required for LFTRC Alternative 4, it is not expected that fill material from off-island sources would be necessary to meet this fill requirement. An estimated 66 new concrete munitions storage magazines would be constructed (see proposed Magazine Relocation Area in Figure 2.5-5) to accommodate the transfer of munitions from the existing magazines that would be encumbered by the range SDZs. The existing magazines would be abandoned in place.

Alternative 4 would be divided between two locations: the MPMG Range and range maintenance facility would be located in the same respective locations identified in Alternative 3 (Section 2.5.4.3) and the other ranges would be located on adjacent non-federal property to the southeast of the NAVMAG (near the area of Alternative 2 (Section 2.5.4.2). Though the layout of the ranges would not be contiguous, they would all be contained within a single complex as required by the Marine Corps guiding principles. Access to the MPMG Range and range maintenance building would be the same as described in Section 2.5.4.3 for Alternative 3. Approximately 1 mile (1.6 km) of new roadway would be required.

Access to the ranges located east of the NAVMAG would occur via a new access road from Route 4. The new access road would follow the existing road from Route 4 to the Dandan Communication Site and then would continue to the KD Rifle Range. Access between the ranges proposed in the southeastern portion of the LFTRC would be via approximately 3.0 miles (4.8 km) of new roads constructed as part of the LFTRC.

Utilities

Planned utilities to the MPMG Range and range maintenance facility are the same as those described for Alternative 3 (Section 2.5.4.3). Utilities and communications for the ranges southeast of the NAVMAG area would follow existing Dandan Road and the proposed new access road. Utility easements on these roads would be obtained. Due to the numerous permutations for IT/COMM, this utility is covered for all LFTRC alternatives and permutations between cantonment/family housing and LFTRC alternatives in Section 2.6.

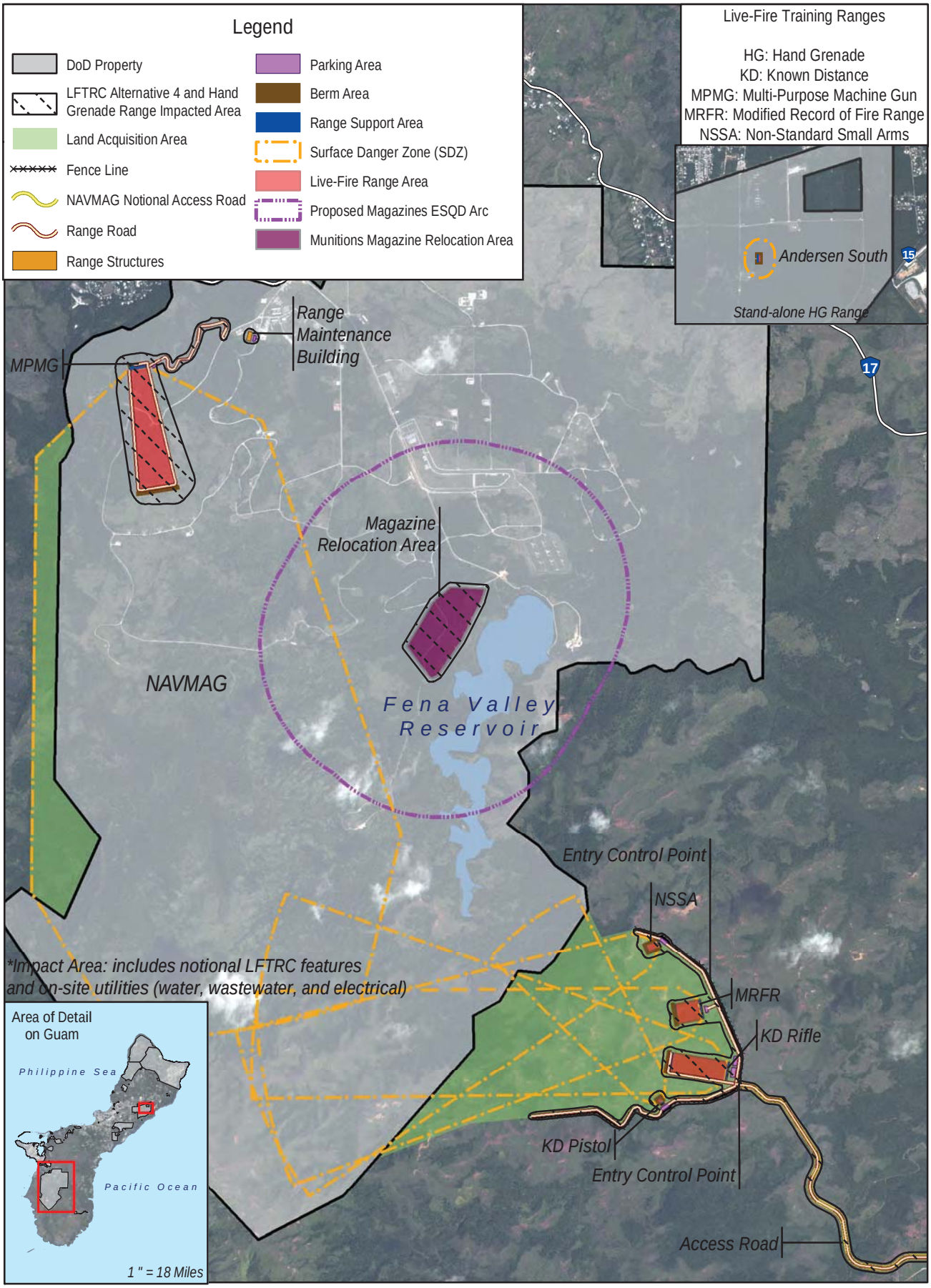


Figure 2.5-5
Proposed NAVMAG (L-Shaped)
LFTRC Alternative 4

Electrical Power

Power to LFTRC Alternative 4 areas southeast of the NAVMAG would be from an existing GPA-owned underground power line that runs along Dandan Road. New electrical lines would be installed in an underground concrete encased conduit duct bank routed along the proposed new access road to the LFTRC entry control point. For areas within the existing NAVMAG areas, electrical power would be provided in the same fashion as in Alternative 3. Underground distribution lines in concrete encased conduit duct banks would be installed to the various ranges and facilities requiring electrical power along the range access roadways and within the range footprints. Pad mounted distribution transformers would be provided as needed.

Potable Water

Potable water service for the proposed LFTRC ranges to the southeast of the NAVMAG would only be required for the KD Pistol/KD Rifle Range Administrative Building. A new 10,130 foot (3,088 m) long water main would be constructed along the proposed new access road to connect with the existing GWA water line in Dandan Road and the LFTRC entry control point. In addition, 2,440 feet (744 m) of lateral service pipes would be installed along the proposed range access roads. A fire hydrant or stand pipe would be installed to facilitate filling range firefighting vehicles. For water service to the Range Maintenance Building within NAVMAG, water would be provided as described in Alternative 3. New water distribution pipes would be installed underground at least 3.0 feet (0.9 m) deep. The width of the installation trench would be about 1.5 feet (0.5 m) to 2.0 feet (0.6 m) for 6 inch (15 cm) to 12 inch (30 cm) pipes. Larger excavations would be required for the installation of manholes.

Wastewater

The range maintenance and KD Pistol/KD Rifle Range administrative buildings would require wastewater services. The new wastewater collection system for Alternative 4 is the same as described for Alternative 3 (Section 2.5.4.3) to service the Range Maintenance Building. The KD Pistol/KD Rifle Range Administrative Building would be served by a holding tank that would be periodically emptied. The new Range Maintenance Building wastewater collection system would be installed underground at least 3.0 feet (0.9 m) deep and not more than approximately 5.0 feet (1.5 m) deep. The width of the installation trench would be approximately 2.0 feet (0.6 m) to 3.0 feet (0.9 m) wide. Larger excavations would be required for the installation of manholes. Ranges would be provided with portable toilets requiring periodic servicing. For purposes of this SEIS, it is assumed that the wastewater from the portable toilets would be collected and taken to the Northern District or Apra Harbor WWTPs or wherever an approved septage handling facility is available for treatment and disposal.

Solid Waste

Solid waste generation at the ranges is expected to be minimal during operation. Collection bins would be provided at appropriate locations and periodically emptied, with solid waste taken to the most convenient transfer station for processing and transfer to the appropriate disposal or recycling facility. Those collection bins located on existing NAVMAG facilities would be collected, processed, and disposed along with the solid waste generated by the existing facilities. During construction, all green waste would be processed for reuse (mulch and compost). Construction and demolition debris would be processed for reuse or disposed in existing disposal facilities in accordance with all regulatory requirements, EOs, and DoD requirements.

2.5.4.5 Northwest Field Live-Fire Training Range Complex - Alternative 5

The NWF LFTRC Alternative 5 (Figure 2.5-6) would consist of approximately 4,016 acres (1,625 ha) (not including the HG Range at Andersen South). Although Alternative 5 would not require acquisition of lands, access to areas within the Ritidian Unit of the Guam NWR that fall within the boundaries of range SDZs would be restricted when ranges are in use. The Ritidian Unit of the Guam NWR is owned and managed by the USFWS. The DON would pursue an agreement with USFWS in accordance with the provisions of Section 2822 of the FY 2015 National Defense Authorization Act (NDAA) which would allow for the continued management of the Ritidian Unit consistent with the purposes for which it was established and the operation of the range SDZs associated with the LFTRC alternative at NWF. The DON anticipates that access restrictions will be addressed in this agreement.

Construction of Alternative 5 would cause direct disturbance to approximately 315 acres (128 ha) of land, including 256 acres (104 ha) for the construction of the individual ranges, range support building, range towers, internal range access roads, a perimeter fence (all within federally controlled land at NWF), and the relocation of the USFWS facilities within the Ritidian Unit of the Guam NWR that would be encumbered by the range SDZs. The remaining approximately 59 acres (24 ha) of disturbed area would be required for construction to improve existing roadways from the intersection of Routes 3, 3A, and 9 to the Ritidian Unit of the Guam NWR. Any decisions regarding the relocation of the USFWS facilities and/or construction to improve beach access at the Ritidian Unit of the Guam NWR are dependent upon the outcome of consultations under section 7 of the ESA and negotiation of the agreement authorized by Section 2822 of the FY 2015 NDAA. The remaining 3,701 acres (1,498 ha) in the overall Alternative 5 footprint would include additional lands and submerged lands under the exclusive custody and control of the DON and the USFWS within the SDZ that would not be affected by construction. This includes approximately 267 acres (108 ha) of the Ritidian Unit of the Guam NWR and 3,434 acres (1,390 ha) of the submerged lands of the Philippine Sea. Grading requirements for Alternative 5 LFTRC construction would include 2,047,295 yd^3 (1,565,270 m^3) of cut and 1,932,392 yd^3 (1,477,420 m^3) of fill, resulting in a net of 114,903 yd^3 (87,850 m^3) of cut material available for use as needed.

Alternative 5 ranges would be constructed in a single location on federal land. Proposed entry to the LFTRC would be through a new entry control point located to the northwest of the current NWF Gate off of Route 3A. The existing road and gate would be improved to support LFTRC traffic, and an entry control point would be constructed to control access during hours of operation. Secondary access would occur via existing access roads on the NWF complex. Specific design details associated with the proposed road and gate alignments are topics of ongoing discussions between the Marine Corps, Air Force, and Navy planners. Approximately 5 miles (8 km) of roads would be constructed or improved to provide access to and between the individual ranges and to the relocated USFWS facilities from the main LFTRC access road (see Figure 2.5-6). Any decision regarding the relocation of the USFWS facilities and/or construction to improve access at the Ritidian Unit of the Guam NWR is dependent on the outcome of consultations under section 7 of the Endangered Species Act and negotiation of the agreement authorized by Section 2822 of the FY 2015 NDAA.

Utilities

Due to the numerous permutations for IT/COMM, this utility is covered for all LFTRC alternatives and permutations between cantonment/family housing and LFTRC alternatives in Section 2.6.

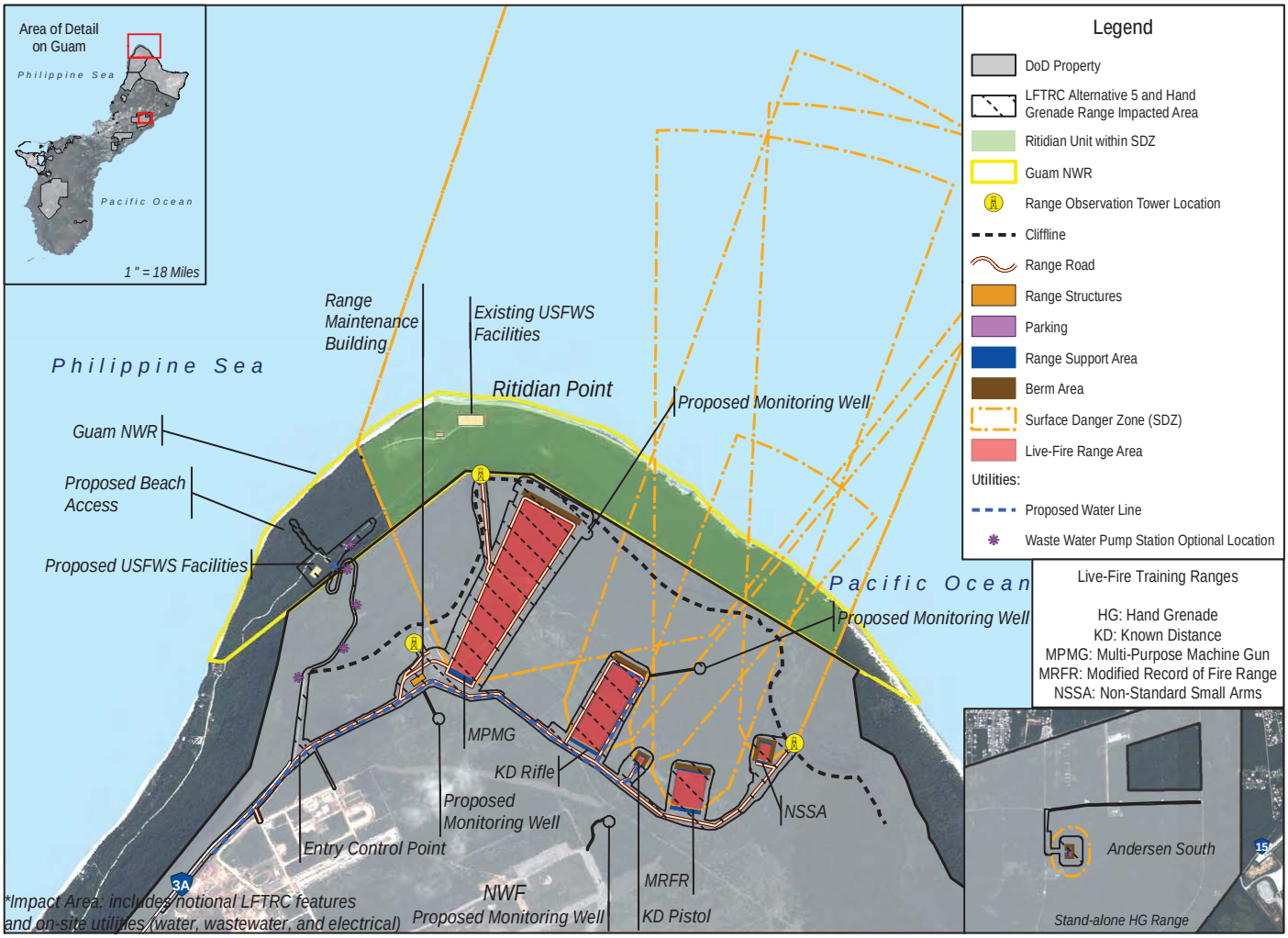


Figure 2.5-6
Proposed NWF LFTRC Alternative 5

Electrical Power

Power to the LFTRC NWF site and relocated USFWS facilities would extend from the existing three phase 13.8 kV overhead line on the AAFB Perimeter Road currently serving the existing USFWS facilities. This existing line would be connected at an existing power pole and be extended to the LFTRC facilities by underground lines in concrete encased conduit banks and manholes along the range access roads. Pad mounted transformers would be located near each Range Operations Tower, Observation Towers, and range facilities to transform the 13.8 kV lines to 120/240 voltage.

The relocated USFWS facilities would be provided electrical power by tapping into an existing 13.8-kV line on an existing power pole where Route 3A forks at Perimeter Road. The new line would be underground and routed along the existing Ritidian Point access road in concrete encased conduit.

Potable Water

Potable water service would only be required for the range maintenance building and KD Pistol/Rifle Range administration building, along with new service to the relocated USFWS facility. Alternative 5 would include construction of approximately 10,500 feet (3,200 m) from a point of connection near the intersection of Road 8 and Road 10. Water service lateral with water meter and backflow preventer would be provided to these buildings. A fire hydrant or stand pipe would be installed to facilitate filling range firefighting vehicles. These water lines would be installed at least 3.0 feet (0.9 m) deep. The width of the trench to install the pipes would be about 1.5 feet (0.5 m) to 2.0 feet (0.6 m) for 6 inch (15 cm) to 12 inch (30 cm) pipes. Larger excavations would be required for the installation of manholes. The relocated USFWS facilities would be connected to the existing water line in the existing access road leading to the prior facility location. Water service from this line would require confirmation.

Wastewater

The range maintenance and KD Pistol/Rifle Range administration buildings would require sewer service. The wastewater system would be a combination of gravity sewer line, septic tank, and self-contained vegetated effluent disposal basin, in accordance with regulatory requirements. This wastewater collection system was proposed to provide a technically and environmentally acceptable sewer disposal solution for Alternative 5 where very low volume of sewage is generated in long pipe runs resulting in inadequate flushing.

The new wastewater collection system for the relocated USFWS building would include a combination of gravity sewer line, septic tank, and self-contained vegetated effluent disposal basin, in accordance with regulatory requirements. An optional wastewater collection system would include 980 feet (300 m) long gravity main, manholes, five small packaged WWPS to handle the elevation difference, and 5,900 feet (1,800 m) of force main to tie into the existing collection system at NWF. Wastewater would be conveyed to the GWA wastewater collection system and to the Northern District WWTP for treatment and disposal. As a second option, a holding tank could be installed, requiring periodic cleanout and delivery of wastewater to the Northern District WWTP for treatment and disposal.

The new wastewater collection system would be installed underground with a minimum 3.0 feet (0.9 m) cover to approximately 5.0 feet (1.5 m) deep, or sometimes deeper if needed. The width of the installation trench would be approximately 2.0 feet (0.6 m) to 3.0 feet (0.9 m) wide. Larger excavations would be required for the installation of manholes, septic tank, and effluent disposal basin. Ranges would be provided with portable toilets requiring periodic servicing. For purposes of this SEIS, it is assumed that the wastewater from the portable toilets would be collected and taken to the Northern District WWTP where a septage handling facility is available for treatment and disposal.

Solid Waste

Solid waste generation at the ranges is expected to be minimal during operation. Collection bins would be provided at appropriate locations and periodically emptied, with solid waste taken to the most convenient transfer station for processing and transfer to the appropriate disposal or recycling facility. During construction, all green waste would be processed for reuse (mulch and compost). Construction and demolition debris would be processed for reuse or disposed in existing disposal facilities in accordance with all regulatory requirements, EOs, and DoD requirements.

2.5.4.6 Stand-Alone Hand Grenade Range (All Live-Fire Training Range Complex Alternatives)

A review of the requirement for the HG range associated with the LFTRC after consideration of scoping input determined that training at the HG Range is enhanced when co-located with military operations in urban terrain and maneuver training areas located at Andersen South. The HG Range would be located on DoD land at Andersen South for all LFTRC alternatives (Figure 2.5-7). Potential for noise from the HG Range to extend off base and inability to site the HG Range within airspace that overlays a portion of Andersen South limits the siting of the HG Range to the central area within Andersen South. Construction of the HG Range would encompass a land area of 24 acres (10 ha), which includes the range, practice area, access road, parking area, and utility installation. The HG Range would be surrounded by a 31 acre (12 ha) SDZ. Grading requirements for construction of the HG Range would involve 8,894 yd^3 (6,800 m^3) of cut and 12,641 yd^3 (9,665 m^3) of fill, for a net requirement of 3,747 yd^3 (2,865 m^3) of fill. When combined with LFTRC construction under Alternatives 1, 3, or 5, the net cut material generated by construction of the LFTRC would provide sufficient additional fill to meet the net fill requirement at the HG Range. When combined with LFTRC construction under Alternatives 2 or 4, which would also have a net fill requirement, the HG Range would add 3,747 yd^3 (2,865 m^3) to the combined fill requirement for each of those alternatives. However, since grading requirements for any of the cantonment/family housing alternatives would generate a net amount of cut material in excess of the total fill required for either LFTRC Alternative 2 or 4 (inclusive of the HG Range), it is not expected that fill material from off-island sources would be necessary to satisfy the fill requirement.

Utilities

The only utilities required for the proposed HG Range would be electrical power and solid waste (described below) and IT/COMM (described in Section 2.6).

Electrical Power

In the area of the proposed HG Range, there are existing GPA overhead distribution lines. New electrical service would be connected to these lines with a single phase 13.8 kV line adjacent to the HG Range location, transition to underground for routing via concrete encased conduit to required locations, and be provided with a pad-mounted distribution transformer.

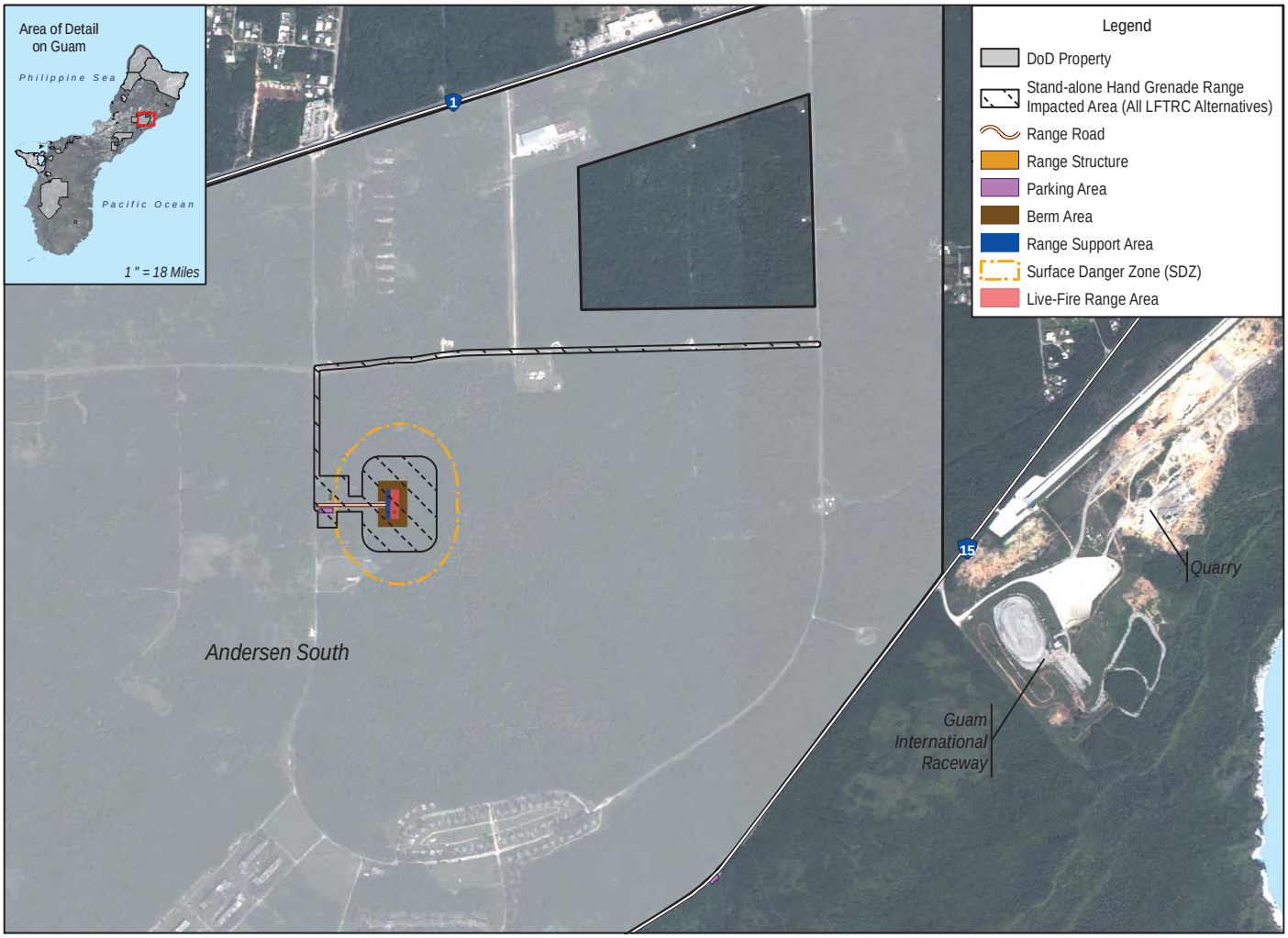


Figure 2.5-7
Stand-alone Hand Grenade Range (All LFTRC Alternatives)

Solid Waste

Solid waste generation at the HG Range is expected to be minimal during operation. Collection bins would be provided at appropriate locations and periodically emptied, with solid waste taken to the most convenient transfer station for processing and transfer to the appropriate disposal or recycling facility. During construction, all green waste would be processed for reuse (mulch and compost). Construction and demolition debris would be processed for reuse or disposed in existing disposal facilities in accordance with all regulatory requirements, EOs, and DoD requirements.

2.5.4.7 Summary of Live-Fire Training Range Complex Alternatives

The five LFTRC alternatives would require between 3,572 acres (1,446 ha) for NAVMAG (North/South) Alternative 3 and 4,918 acres (1,990 ha) for NAVMAG (L-Shaped) Alternative 4. This includes the construction footprint for the ranges and associated facilities, the additional SDZ area required that would not be impacted by construction, including lands and submerged lands, the stand-alone HG Range proposed at Andersen South, and the access road required for NAVMAG (East/West) Alternative 2 and NAVMAG (L-Shaped) Alternative 4. Table 2.5-2 provides a comparison of the land area required for each LFTRC alternative discussed in Section 2.5.4.1 through 2.5.4.5.

Table 2.5-2. Summary Comparison of Land Area Included in LFTRC Alternatives (acres / ha)[1]

	Route 15 Alternative 1	***NAVMAG (East/West) Alternative 2***	***NAVMAG (North/South) Alternative 3***	***NAVMAG (L-Shaped) Alternative 4***	***NWF Alternative 5***
LFTRC Construction Footprint	383 / 155	275 / 111	370 / 150	356 / 144	256 / 104
LFTRC SDZ Area	3,379 / 1,367	3,433 / 1,389	3,179 / 1,286	4,418 / 1,788	3,701 / 1,498
Stand-alone HG Range at Andersen South	23 / 9	23 / 9	23 / 9	23 / 9	23 / 9
External Access Road	0 / 0	107 / 43	0 / 0	121 / 49	59 / 24
Total Area	**3,785 / 1,532**	**3,838 / 1,553**	**3,572 / 1,446**	**4,918 / 1,990**	**4,039 / 1,635**

Notes: [1]The No-Action Alternative is not included in this or the following table because a decision regarding the LFTRC would continue to be deferred under the No-Action Alternative, as it was in the 2010 ROD.

Table 2.5-3 provides a comparison of the amount of non-federal land that would need to be acquired for each of the LFTRC alternatives. This table includes a minimum and maximum land acquisition estimate for each alternative.

Table 2.5-3. Summary Comparison of Non-Federal Land Acquisition Requirements for LFTRC Alternatives (acres / ha)

	Route 15 Alternative 1	***NAVMAG (East/West) Alternative 2***	***NAVMAG (North/South) Alternative 3***	***NAVMAG (L-Shaped) Alternative 4***	***NWF Alternative 5***
Minimum Land Acquisition if Parcels Subdivided[1]	896 / 363	1,894 / 766	252 / 102	914 / 370	0
Maximum Land Acquisition (Parcels Not Subdivided)[2]	915 / 370	3,648 / 1,476	905 / 366	3,671 / 1,486	0

Notes: [1] Assumes that the minimum amount of land required could be acquired, which would require subdividing larger parcels.
[2] Assumes that subdivision of larger parcels encompassing the required land would not be achievable and larger parcels would need to be acquired.

2.6 INFORMATION TECHNOLOGY/COMMUNICATIONS

IT/COMM would require inter-base connections between the new Marine Corps cantonment area and other existing bases, the LFTRC, and training facilities at Andersen South (covered by the 2010 Final EIS and ROD). These hardwired connections would consist of up to twelve 4 inch (10 centimeter [cm]) diameter conduits buried approximately 3.0 feet (0.9 m) deep. Off-site conduits would be encased in concrete and would have lockable manholes. Because redundant off-island communication paths are necessary, additional easements and connection to the Tata Communications cable termination facility from AAFB would be required. Off-site conduits would be installed along existing roads and within existing easements between the facilities, as shown in Figures 2.6-1 through 2.6-5, and would be installed within the same corridor (though not in the same trenches) wherever the IT/COMM alignment overlaps with other proposed utility routings. Each of these figures focuses on a particular LFTRC alternative and displays the corresponding IT/COMM routings between that alternative and the various cantonment/family housing alternatives. It should be noted that Alternatives 2 and 4 would require some additional alternative-specific easements for utilities and IT/COMM.

The size of the potential construction footprint for the IT/COMM lines associated with each pairing of a cantonment/family housing alternative with an LFTRC alternative is shown in Table 2.6-1.

Table 2.6-1. Construction Footprint Area for Routing of IT/COMM Links Between Alternatives (acres / ha)

Cantonment/Family Housing Alternatives	***LFTRC Alternatives***				
	Route 15 Alternative 1	***NAVMAG (East/West) Alternative 2***	***NAVMAG (North/South) Alternative 3***	***NAVMAG (L-Shaped) Alternative 4***	***NWF Alternative 5***
Alternative A: Finegayan	416 / 168	563 / 228	537 / 217	566 / 229	431 / 174
Alternative B: Finegayan/South Finegayan	416 / 168	563 / 228	537 / 217	566 / 229	431 / 174
Alternative C: AAFB	352 / 142	522 / 211	496 / 201	524 / 212	390 / 158
Alternative D: Barrigada	431 / 174	561 / 227	534 / 216	563 / 228	515 / 208
Alternative E: Finegayan/ AAFB	416 / 168	563 / 228	537 / 217	566 / 229	431 / 174

Source: NAVFAC Pacific 2013.

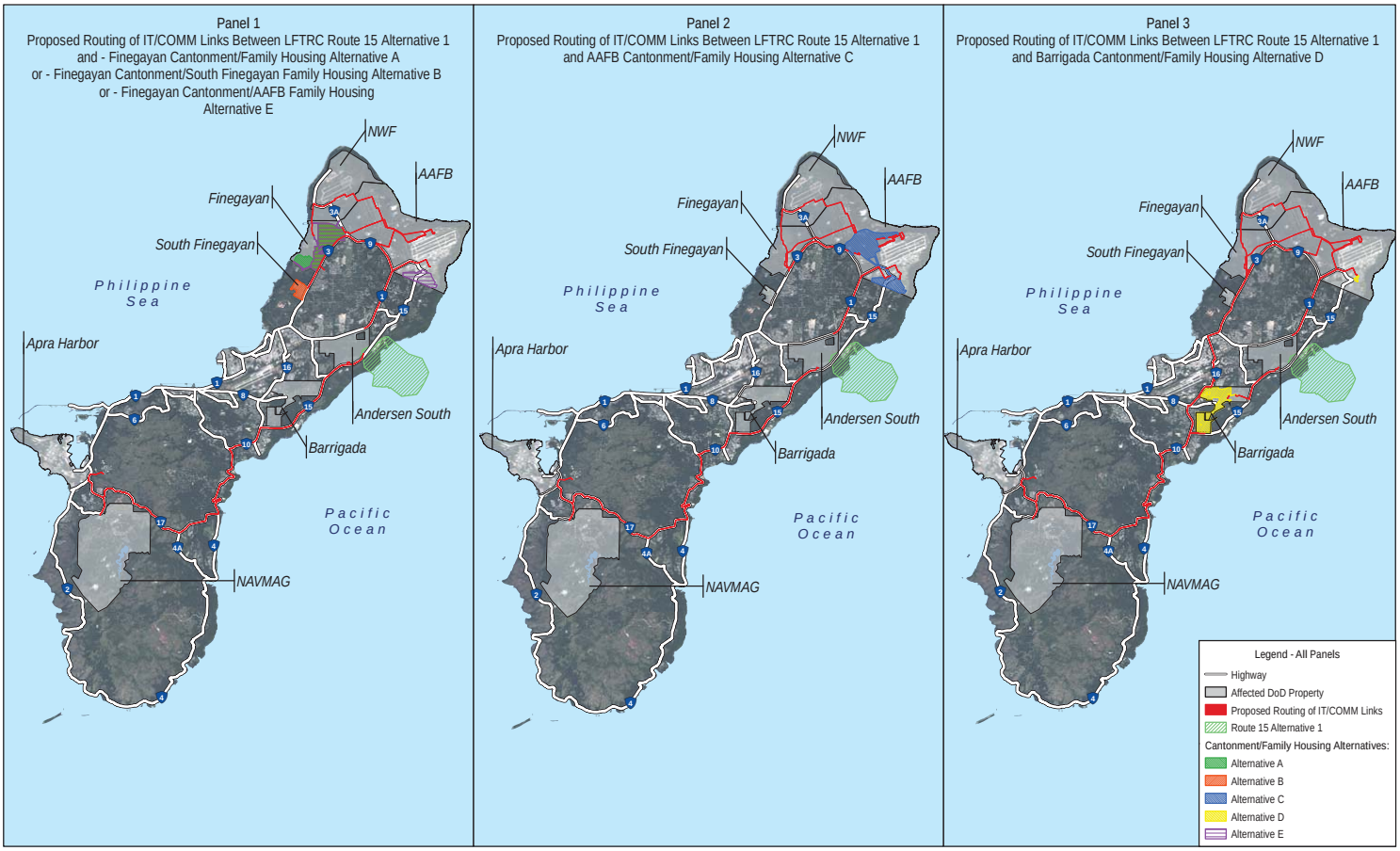


Figure 2.6-1
Routing of Proposed IT/COMM Links between
LFTRC Route 15 Alternative 1 and Each Cantonment/Family Housing Alternative

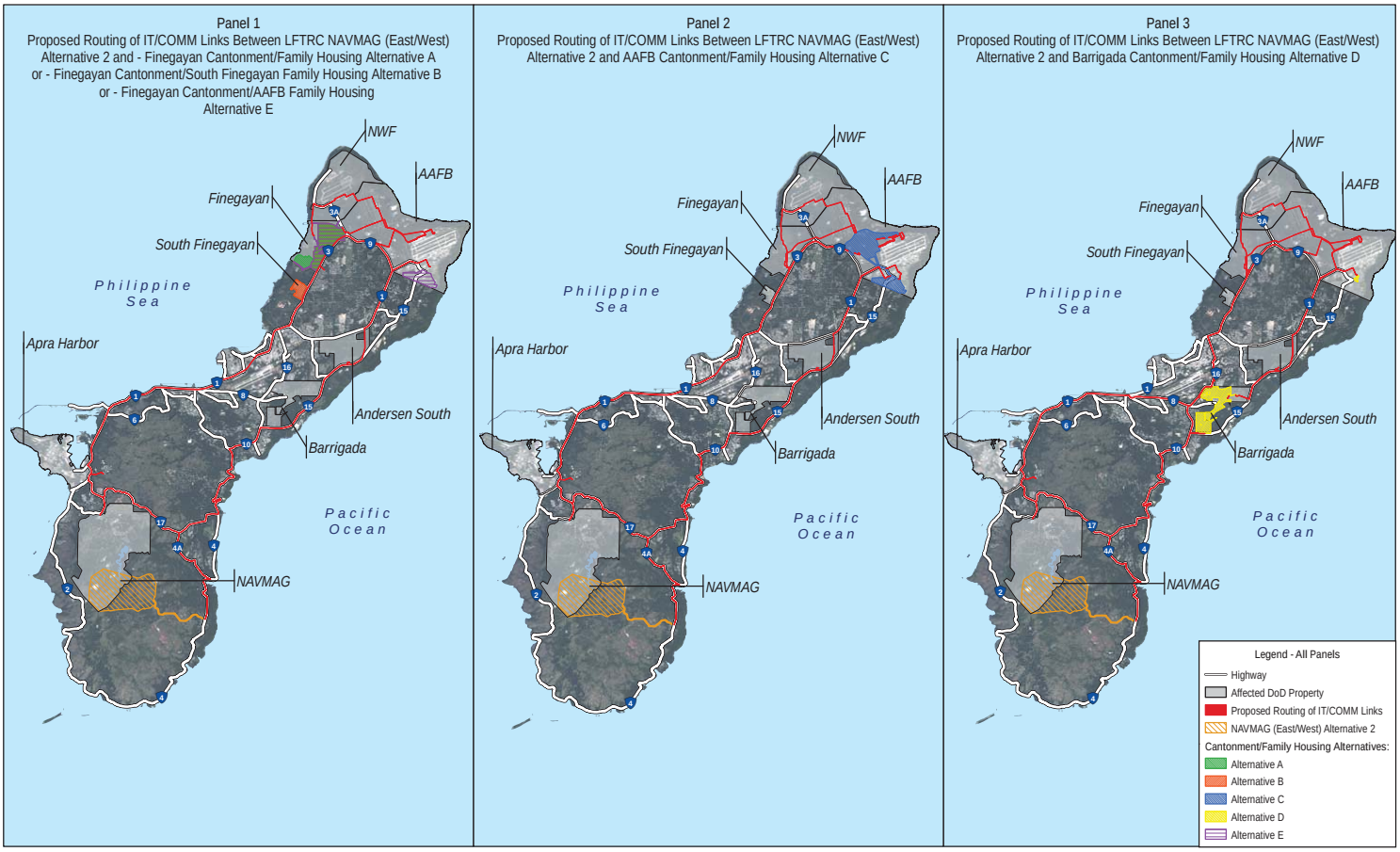


Figure 2.6-2
Routing of Proposed IT/COMM Links between
LFTRC NAVMAG (East/West) Alternative 2 and Each Cantonment/Family Housing Alternative

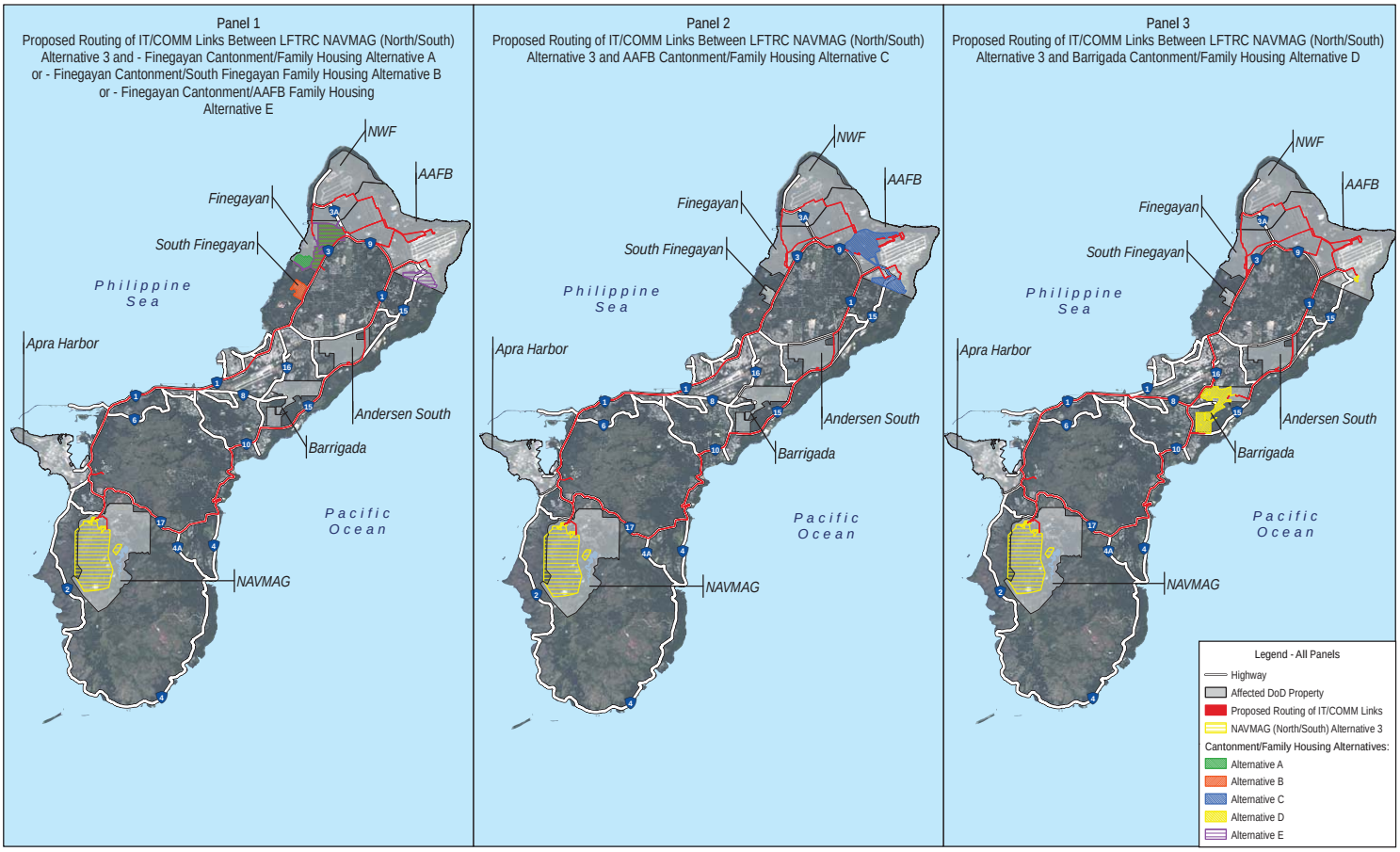


Figure 2.6-3
Routing of Proposed IT/COMM Links between
LFTRC NAVMAG (North/South) Alternative 3 and Each Cantonment/Family Housing Alternative

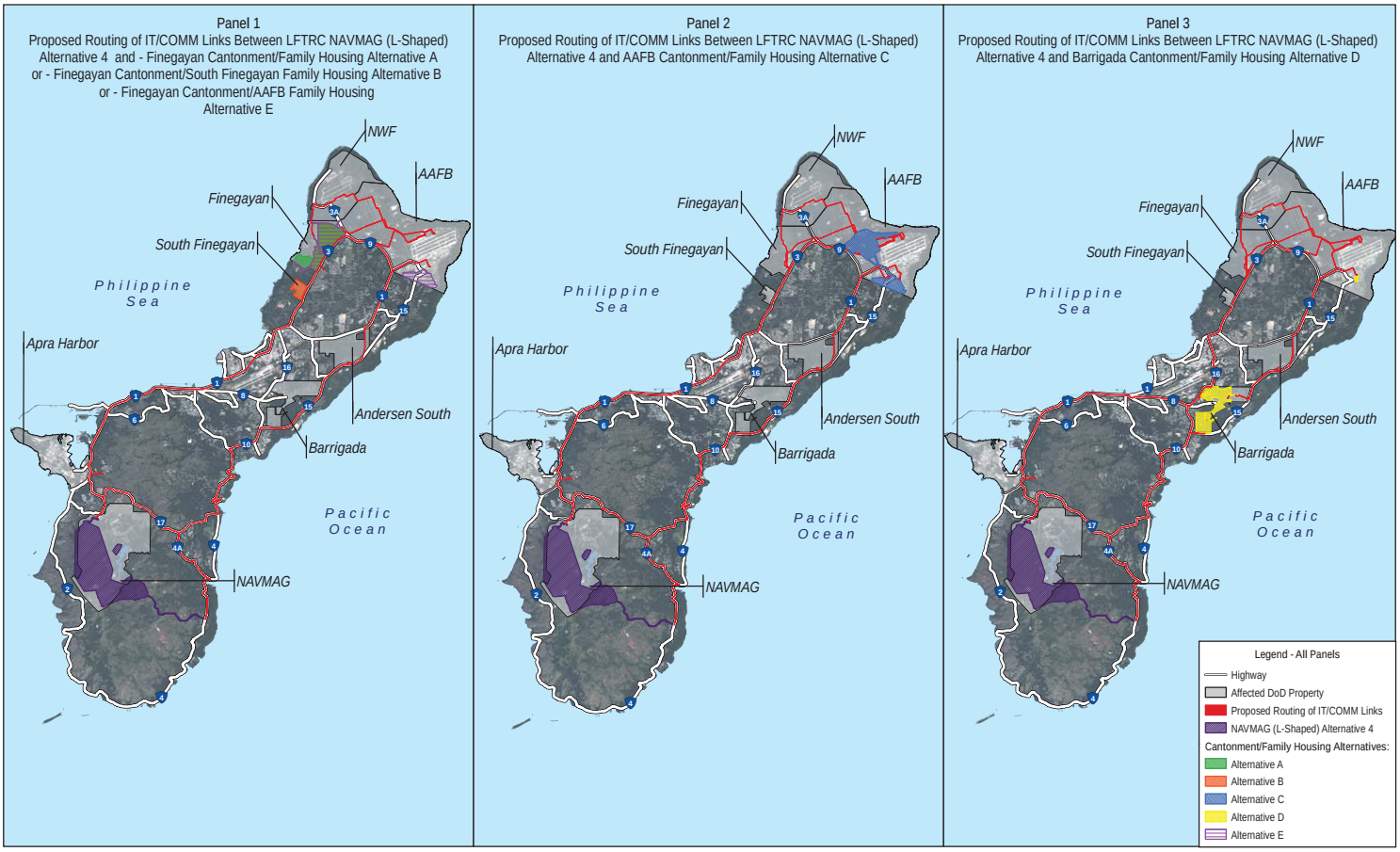


Figure 2.6-4
Routing of Proposed IT/COMM Links between
LFTRC NAVMAG (L-Shaped) Alternative 4 and Each Cantonment/Family Housing Alternative

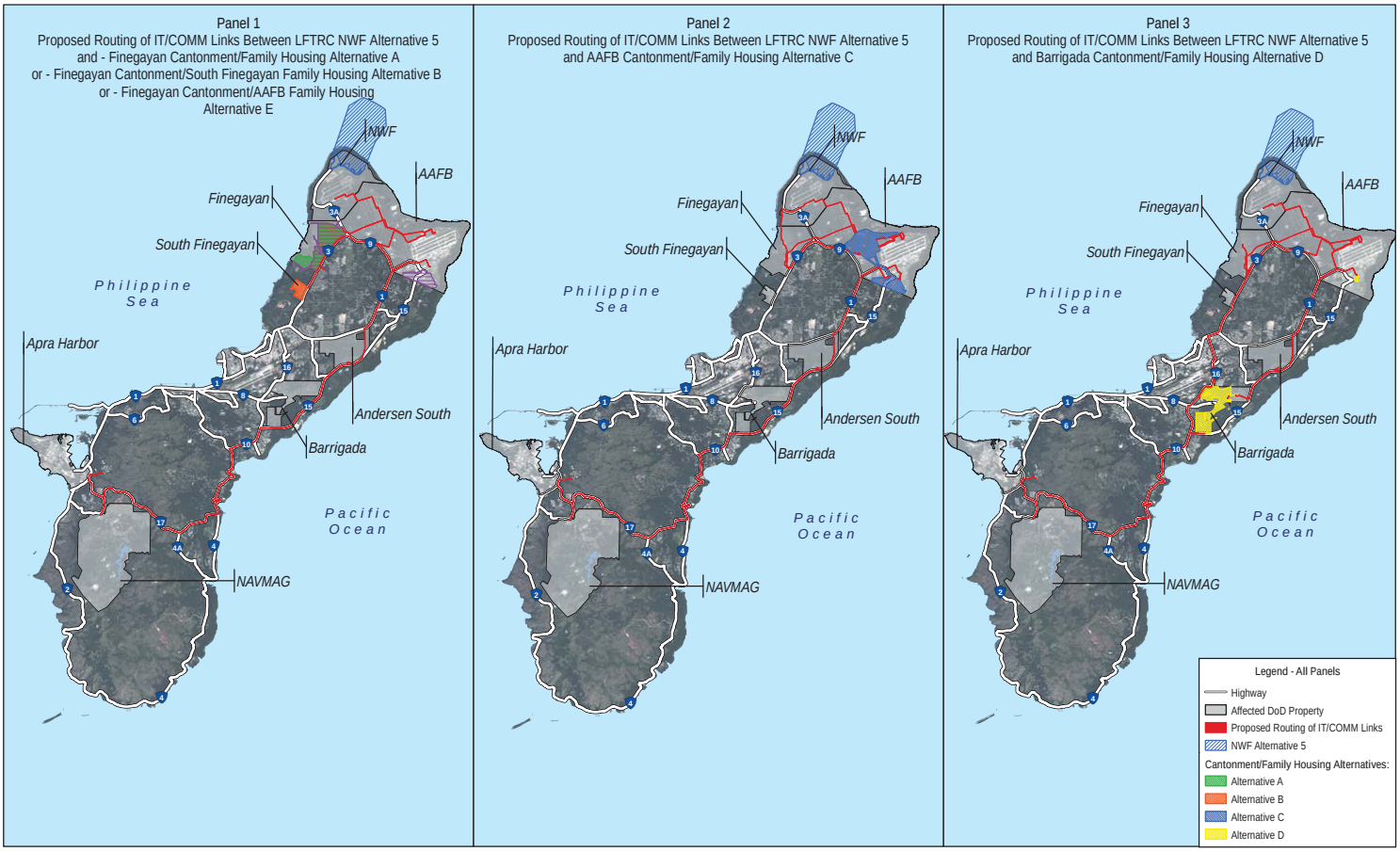


Figure 2.6-5
Routing of Proposed IT/COMM Links between
LFTRC NWF Alternative 5 and Each Cantonment/Family Housing Alternative

2.7 IDENTIFICATION OF THE PREFERRED ALTERNATIVE

According to the CEQ, the agency's preferred alternative is the alternative that the agency believes best fulfills its statutory mission and responsibilities, giving consideration to economic, environmental, technical and other factors (40 CFR 1502.14(e)). The DON considered military requirements, known infrastructure and environmental impacts and constraints, and input from the public, resource agencies, and GovGuam to identify a preferred alternative. The DON's preferred alternative is to construct and operate a cantonment at Finegayan and a family housing area at AAFB (Alternative E), plus an LFTRC at NWF (Alternative 5). This preferred alternative is different than what was identified in the Draft SEIS. Similar to the Draft SEIS preferred alternative (Alternative A [cantonment and family housing at Finegayan]), this new preferred alternative still meets Marine Corps operational requirements, maximizes the use of federal land on Guam, and optimizes operational efficiencies due to the relative proximity of the cantonment and LFTRC to one another. Additionally, compared to the preferred alternative in the Draft SEIS, this new preferred alternative would reduce the amount of vegetation that would have to be cleared, present additional opportunity for forest enhancement mitigation, maintain the natural buffer area between developed areas and nearby sensitive coastal resources, and leverage existing family housing support facilities already in place at AAFB. This combination best meets Marine Corps operational requirements (size and layout), while maximizing the use of federal land on Guam, and optimizes operational efficiencies due to the relative proximity of the facilities. Figure 2.7-1 illustrates the components of the preferred alternative.

2.8 BEST MANAGEMENT PRACTICES INCLUDED IN PROPOSED ACTION

This section presents an overview of the BMPs that are incorporated into the proposed action in this SEIS. For the purposes of this SEIS, BMPs are existing policies, practices, and measures that the DON would adopt to reduce the environmental impacts of designated activities, functions, or processes. Although BMPs mitigate potential impacts by avoiding, minimizing, or reducing/eliminating impacts, BMPs are distinguished from potential mitigation measures proposed in this SEIS because BMPs are (1) existing requirements for the proposed action, (2) ongoing, regularly occurring practices, or (3) not unique to this proposed action. In other words, the BMPs identified in this SEIS are inherently part of the proposed action and are not potential mitigation measures proposed as a function of the NEPA environmental review process for the proposed action.

Table 2.8-1 includes a list of BMPs for applicable resources. Resources that have no identified BMPs are not listed in this table. This list represents a menu of BMPs that are available to reduce the impacts for each component of the proposed action. The selection of applicable BMPs would be project-specific. In accordance with applicable environmental permits implementing statutes and regulations, the selection of specific construction-related BMPs are left to the discretion and judgment of engineering and environmental professionals during development of various design and construction plans, and are often subject to review by federal or local agency with jurisdiction. Other BMPs that are not clearly required by statute or regulation and are not subject to review by a federal or local agency would be more specifically described to ensure its purpose is clear to the reader.

In addition to the listed BMPs that the DON would implement proactively, potential mitigation measures intended to address specific impacts are identified in the resource-specific impact analyses and summarized in Chapter 4, Table 4.7-1 and Chapter 5, Table 5.7-1.

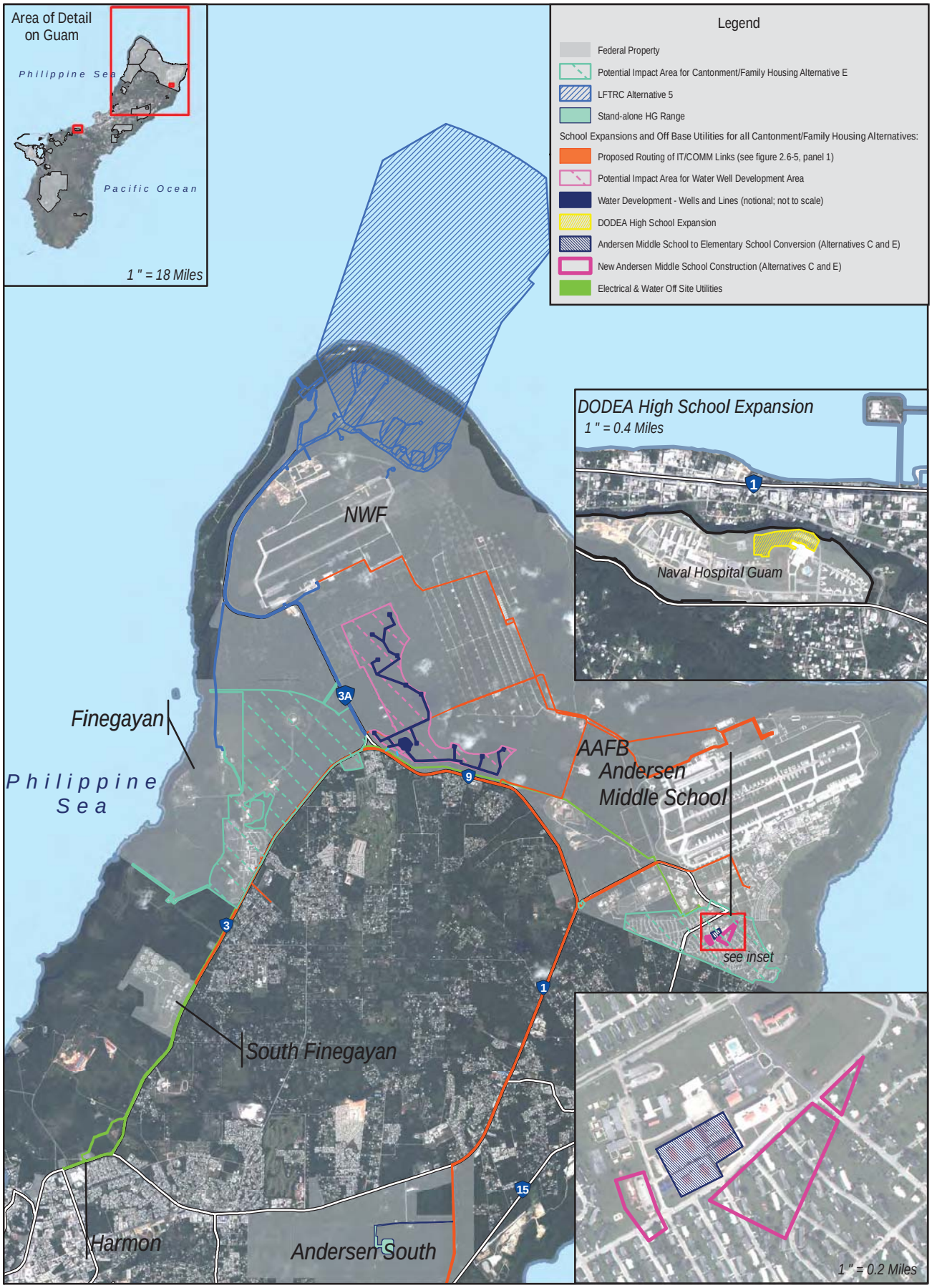


Figure 2.7-1
Preferred Alternative

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
GEOLOGICAL AND SOIL RESOURCES			
Compliance with all applicable rules and regulations regarding import of off-island earth materials.	Should there be a need to import off-island earthen fill materials, follow all GEPA, Department of Agriculture, and local rules and regulations regarding import of off-island earth materials.	Prevent/minimize potential for contaminated earth materials to enter Guam.	Pre-C C
Earthquake-resistant design and construction.	Follow standards of 3-310-04 Seismic Design of Buildings dated June 1, 2013 during project design and construction.	Minimize potential geologic hazards associated with construction and operation of the proposed action.	Pre-C C
Implement Engineering Controls during design and construction per Title 22 GAR, Chapter 10 Guam Soil Erosion and Sediment Control Regulations and Measures for Protection of Sinkholes.	• Use drainage diversion and control to direct stormwater flow away from construction sites. • Use benches or terraces and drainage control on cut or fill slopes higher than 15 feet to minimize erosion on slope faces. • For each project, limit the size of the unstabilized disturbed areas to less than 20 acres (8 ha) during construction. • Plan earth-moving operations for periods of low rainfall. Re-vegetate and permanently stabilize disturbed areas as soon as possible. • For sinkholes within the project development footprint that would be modified or used, an environmental and hydrogeologic assessment must be performed.	These measures reduce potential for exposure of disturbed soil to rainfall and runoff, thus reducing potential for increased erosion of soil by water, and ensure adverse effects will not result in the displacement of groundwater, interference with well production, significant changes to groundwater recharge, flooding, or the threat or introduction of any pollutant to groundwater.	Pre-C C
Erosion Control Plan.	Plan is required before any properties can be cleared and graded. Potential erosion control BMPs may include, but may not be limited to: • Check Dam. • Diversion Dike/Swale. • Level Spreader. • Fiber Rolls. • Vegetated and Lined Waterways. • Rock Outlet Protection. • Erosion Control Blankets. • Stabilization with Vegetation, Sod, Mulch, or Topsoil.	Minimizes potential impacts to soil from erosion by diverting, controlling, and slowing runoff. Eliminates and/or minimizes the potential for nonpoint source pollution within Guam's waters such as fertilizers, pesticides, sediment, and other pollutants present in stormwater runoff.	Pre-C C Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
Stormwater Pollution Prevention Plan (SWPPP).	DoD facilities are required to comply with the Program-level SWPPP for construction, in addition to individual project SWPPPs during construction and then during day to day operations, to ensure that stormwater remains free of contaminants. A SWPPP is a self-implementing plan for compliance with the Construction General Permit and an installation's stormwater permit. It requires regular site inspections and development of pollution prevention measures, including BMPs, to reduce and control pollutants in stormwater discharge. In addition to the measures listed under the Erosion Control Plan, potential BMPs may include, but may not be limited to: • Perimeter Dike/Swale. • Sediment Basin. • Sediment Trap. • Silt Fence. • Gravel/Sand Bag Berms. • Stabilized Construction Entrance/Exit. • Storm Drainage Inlet Protection. • Straw Bale Dike.	The SWPPP identifies BMPs to address runoff reduction and reduce impacts to soil from erosion.	Pre-C C Ops
Tsunami hazard communications and evacuation procedures (for NWF LFTRC Alternative 5 construction workers).	For Alternative 5 construction, notify workers involved with demolition of low-elevation USFWS facilities of potential tsunami hazard at site. Provide communications and evacuation procedures to ensure all site personnel are alerted to an approaching tsunami and move to safety.	Reduce/minimize potential human exposure to tsunami hazard during Alternative 5 construction period.	Pre-C C
Range Fire Management Plan.	Prepare a Range Fire Management Plan, based on the DON's Wildland Fire Management Plan (Nelson 2008), to reduce fuel loads and fire potential on proposed ranges. The Range Fire Management Plan would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions); location and management of fire breaks, fire-fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the	Reduces risk of fire originating from the range, thereby minimizing potential for fire impacts, including impacts associated with vegetation destruction and increased soil erosion.	Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
	range would shut down and how fire suppression action would be taken).		
Manage live-fire ranges in accordance with current Marine Corps range management policies and procedures and MCO 3550.10 Policies and Procedures for Range Training Area Management.	Develop range specific standard operating procedures, which may include, but may not be limited to the following: • Maintain grassy vegetation on berms. • Manage stormwater at ranges. • Restrict vehicular activities at ranges to designated/previously identified areas. • Conduct monitoring and range clearance (remove expended rounds) of live-fire ranges with impact berms at a minimum of every 5 years (Note: under the Range Environmental Vulnerability Assessment (REVA) Program, fate and transport modeling using site-specific data will be used to determine the appropriate frequency of monitoring and range clearance).	These measures minimize impacts to soil from erosion and potential metals contamination associated with range operations.	Ops
WATER RESOURCES			
Erosion Control Plan.	Plan is required before any properties can be cleared and graded. Potential erosion control BMPs may include, but may not be limited to: • Check Dam. • Diversion Dike/Swale. • Level Spreader. • Fiber Rolls. • Vegetated and Lined Waterways. • Rock Outlet Protection. • Erosion Control Blankets. • Stabilization with Vegetation, Sod, Mulch, or Topsoil.	Eliminates and/or minimizes the potential for nonpoint source pollution within Guam's waters such as fertilizers, pesticides, sediment, and other pollutants present in stormwater runoff.	Pre-C C Ops
SWPPP	DoD facilities are required to comply with the Program-level SWPPP for construction, in addition to individual project SWPPPs during construction and then during day to day operations, to ensure that stormwater remains free of contaminants. A SWPPP is a self-implementing plan for compliance with the Construction General Permit and	The SWPPP identifies BMPs to address erosion control, runoff reduction, and sediment removal with the purpose of reducing/avoiding impacts to water resources.	Pre-C C Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
	an installation's stormwater permit. It requires regular site inspections and development of pollution prevention measures, including BMPs, to reduce and control pollutants in stormwater discharge. In addition to the measures listed under the Erosion Control Plan, potential BMPs may include, but may not be limited to: • Perimeter Dike/Swale. • Sediment Basin. • Sediment Trap. • Silt Fence. • Gravel/Sand Bag Berms. • Stabilized Construction Entrance/Exit. • Storm Drainage Inlet Protection. • Straw Bale Dike.		
Compliance with Range Management Plans and REVA.	In compliance with DoD Instruction 4715.14, the Marine Corps will utilize the REVA program to assess the potential impacts to human health and the environment from live fire training operations. The purpose of the REVA is to identify whether there is a release or a substantial threat of a release of munitions constituents (MCs) from the operational range or range complex areas to off-range areas and determine if the release causes an unacceptable risk to human health and/or the environment. The Marine Corps will collect baseline data to support the assessment as part of a baseline survey conducted before the ranges are approved for use. The REVA program will conduct an assessment on all live fire operational ranges after they have been in use for a minimum of a year to determine if MCs are migrating off-range and if follow-on actions are required. Monitoring of the ranges for MCs migrating off-range will be based on the outcome of the assessment that is conducted at a minimum every 5 years.	Reduced potential for release of hazardous materials and waste and contamination of water and biological resources.	Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	***Description***	***Impacts Reduced/Avoided***	***Timing Pre-C, C, Ops***
Water Quality Monitoring Plan.	Water Quality Monitoring Plan may be required to evaluate the effectiveness of any number of different environmental permits and/or performance standards.	Identifies ambient or control conditions at a particular site and detects deviations from those conditions resulting from a project or operations of a facility.	Pre-C C Ops
Low Impact Development (LID).	LID is a design measure that requires the use of innovative methods to capture stormwater that would otherwise flow into nearby watersheds using a combination of retention devices and vegetation to allow stormwater to be retained and managed at the source, rather than relying on downstream efforts to control the flow of water and contaminants. Potential LID measures may include, but may not be limited to: • Stormwater Ponds (Retention/Detention). • Stormwater Wetlands. • Infiltration Practices. • Filtering Practices. • Open Channel Practices. • Minimizing Exposure. LID measures would be consistent with guidelines provided in UFC 3-210-10, stormwater management techniques provided in the *CNMI and Guam Stormwater Management Manual*, as amended in 2010, as well as updated guidance in the 2014 *Stormwater Management in the Pacific and Caribbean Islands: A Practitioner's Guide to Implementing LID.*	Pollutant concentrations at discharge or infiltration points are reduced through the use of measures that treat contaminants in stormwater through physical or biological means. Changes in discharge flow rates at downstream locations are minimized by added storage and infiltration of stormwater upstream.	Pre-C C Ops
LID BMP Operations and Maintenance Inspection Checklist.	Establish a LID BMP O&M Inspection Checklist to be implemented during operations to assess whether appropriate LID measures are designed/sited, properly maintained, monitored, and effective during operations. Any deficiencies would lead to corrective actions.	Impacts to the aquifer and near shore waters reduced through storm water management.	Ops
Spill Prevention and Response Procedures.	Written procedures for cleaning up spills or leaks, notifying the appropriate personnel, and following the reporting procedures.	Reduce/avoid potential impacts to water resources from spills or release of other contaminants and pollutants.	Pre-C C Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
Routine Facility Inspections and Compliance with the Multi-Sector General Permit.	The Multi-Sector General Permit (MSGP) requires the preparation of an Industrial Activity SWPPP. The Industrial Activity SWPPP would include installation/maintenance of pollutant control measures, monitoring of stormwater at discharge outfalls, and employee training. Qualified facility personnel must regularly inspect all areas of the facility where industrial materials or activities are exposed to stormwater for ongoing good housekeeping, spill control equipment, and outdoor storage.	Reduce/avoid potential impacts of facility operations to water resources from spills or release of other contaminants and pollutants.	Ops
Employee Training.	Training must be given to all employees who work in areas where industrial materials or activities are exposed to stormwater, and must include spill response, good housekeeping, and material management practices.	Reduce/avoid potential impacts to water resources from spills or release of other contaminants and pollutants.	Pre-C C Ops
Range Fire Management Plan.	Prepare a Range Fire Management Plan, based on the DON's Wildland Fire Management Plan (Nelson 2008), to reduce fuel loads and fire potential on proposed ranges. The Range Fire Management Plan would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions); location and management of fire breaks, fire-fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken).	Reduces risk of fire originating from the range, thereby minimizing potential for fire impacts, including impacts associated with vegetation destruction and increased soil erosion.	Ops
Road and Bridge Design.	Design measures would place construction work and facilities (including roads) outside of wetlands and other waters of the U.S. to the maximum extent practicable.	Work would be designed and constructed to avoid and minimize impacts to wetlands and other waters of the U.S. to the maximum extent practicable.	Pre-C

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
AIR QUALITY			
Diesel Emissions Control on Off-road Equipment.	• Comply with USEPA's Tier 2 engine emission standards. • Use ultra-low sulfur diesel fuel. • Minimize truck idling time.	Reduces construction period air quality impacts at nearby residences and other occupied areas.	C
Dust Control Plan.	Implement a Dust Control Plan with the following measures when feasible: • Minimize land disturbance. • Construct stabilized construction entrances per construction standard specifications. • Cover trucks when hauling soil, stone, and debris. • Use water trucks to minimize dust. • Stabilize or cover stockpiles. • Minimize dirt tracking by washing or cleaning trucks before leaving the construction site.	Reduces construction air quality impacts at nearby residences and other occupied areas.	C
NOISE			
Equipment Sequencing during Construction.	Plan work such that noise producing heavy equipment is not concentrated in areas adjacent to sensitive receptors.	Reduces construction noise levels at nearby residences and other sensitive receptors.	C
Vegetation Attenuation and Earthen Berms.	Retain dense foliage and/or construct earthen berms between LFTRC and sensitive receptors.	Reduces operational noise at nearby residences and other sensitive receptors.	C
LAND AND SUBMERGED LAND USE			
Installation Master Planning UFC 2-100-01.	Ensures efficient and compatible land use (identifying and respecting natural and man-made constraints) and maximizes facility utilization.	Resolves land use incompatibilities within the installation boundaries.	Pre-C
RECREATIONAL RESOURCES			
Construction Period/Construction Site Traffic Management Plan.	Identify traffic management measures to be implemented during construction phase.	Reduce delays in access to recreational sites.	Pre-C
Notice to Mariners.	The U.S. Coast Guard will announce in the Notice to Mariners the proposed schedule for the use of the LFTRC to inform vessel operators of periods of potential usage.	Notice to Mariners will direct vessel operators to navigate clear of the SDZ to avoid potential impacts from use of the LFTRC.	Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
TERRESTRIAL BIOLOGICAL RESOURCES			
GENERAL BIOLOGICAL RESOURCES			
Contractor Education Program.	The DON education program to ensure construction contractor personnel are informed of the biological resources in the project area, including special-status species, avoidance measures, and reporting requirements.	Inadvertent impacts to terrestrial biological resources due to lack of awareness of resource presence, sensitivities, and protective measures.	Pre-C C
Biosecurity Outreach and Education.	The DON biosecurity outreach and education program to inform the general public, DoD employees, military personnel, and their dependents regarding native vs. non-native species, impacts of non-native species on native species and ecosystems, and what can be done to prevent and control non-native species.	Inadvertent impacts to terrestrial biological resources due to lack of awareness of biosecurity issues related to non-native species.	Pre-C C Ops
Incorporate Biosecurity Measures.	Incorporate biosecurity measures (e.g., brown treesnake interdiction measures, on-site vegetation waste management procedures, outreach/education, and monitoring to evaluate effectiveness of HACCP) into construction, operations or training events.	Inadvertent spread of non-native species on Guam or to other locations off of Guam. The implementation of biosecurity measures decreases the likelihood of introducing pests harmful (either predation or outcompeting native species) to native vegetation, invertebrates, vertebrates, as well as human health.	Pre-C C Ops
Brown Treesnake Interdiction (36 Wing Instruction 32-7004, *Brown Tree Snake Control Plan* and COMNAVMAR Instruction 5090.10A, *Brown Tree Snake Control and Interdiction Plan*).	Joint Region Marianas (JRM) has established a comprehensive brown treesnake interdiction program to ensure that military activities, including the transport of civilian and military personnel and equipment to and from Guam, do not contribute to the spread of brown treesnakes. Interdiction requirements (e.g., trapping and inspections at ports and cargo facilities, aircraft, inspections of household good movements, and biosecurity plans for training events) are specified in DoD instructions as well as the annual Work Financial Plan that is developed in cooperation with USDA Wildlife Services.	Inadvertent spread of brown treesnake to other locations off of Guam.	Pre-C C Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
Range Fire Management Plan.	Prepare a Range Fire Management Plan, based on the DON's Wildland Fire Management Plan (Nelson 2008), to reduce fuel loads and fire potential on proposed ranges. The Range Fire Management Plan would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions); location and management of fire breaks, fire-fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken).	Risk of fire originating from the range, thereby minimizing potential for impacts to biological resources from fire.	Ops
Hazard Analysis and Critical Control Point (HACCP) Plan.	Construction contracts will contain a requirement to develop a HACCP Plan which will identify risks and potential pathways for non-native species and will outline procedures for controlling and removing risks identified. Construction contracts will also contain a requirement for inspections and proper re-use or disposal of vegetation to avoid contributing to the further spread of the coconut rhinoceros beetle. This plan will be approved and inspected by the biological monitor.	Inadvertent spread of non-native species on Guam or to other locations off of Guam.	Pre-C C
VEGETATION			
DON's *Final Guam Landscaping Guidelines.*	Appropriate or non-invasive species will be planted in all new landscapes.	Helps to reduce potential impacts associated with non-native vegetation, promotes habitat for native species, reduces water consumption, and reduces the need for fertilizers.	C
LFTRC Range Berm Controls.	LFTRC range berms will contain native or non-invasive herbaceous vegetation, and other engineering controls.	Helps to manage stormwater runoff and control erosion.	C
Contractor Plans and Specifications.	All construction will occur within the limits of construction shown in the Contractor Plans and Specifications.	Habitat loss.	Pre-C C

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
Coordination with Guam Department of Agriculture: Forestry Division and GDAWR.	To the greatest extent practicable, the DON shall coordinate escorted access to project sites for Guam Department of Agriculture staff prior to vegetation clearing activities. As part of the escorted access, Guam Department of Agriculture will be allowed a reasonable period to perform surveys in areas where vegetation removal is proposed to identify native plant species for the potential extraction of seeds, seedlings, and other specimens. Guam Department of Agriculture may use their findings to assist the DON in practicable efforts to minimize natural resource impacts during project design development. Access will be subject to reasonable scheduling, and when applicable, the completion of required UXO/MEC awareness training.	Promotes local initiatives to propagate native vegetation and leverages local expertise in exploring practicable project-level options for further minimization of losses to habitat.	Pre-C
SPECIAL-STATUS SPECIES			
Pre-Construction Surveys for the Mariana Fruit Bat.	For projects within or in the vicinity of suitable fruit bat habitat, surveys following the USFWS-approved JRM protocol will be conducted 1 week prior to the onset of work. If a fruit bat is present within 492 feet of the project site, the work must be postponed until the bat has left the area.	Avoid and minimize impacts to fruit bats.	Pre-C C
Lighting Installation.	Lighting will be designed to meet minimum safety, sustainability, anti-terrorism, and force protection requirements. Hooded lights will be used to the maximum extent practicable at all new roads and facilities within known fruit bat roost areas. Either hooded or "night-adapted" lights will be installed at the LFTRC. Night-adapted lighting uses bulbs in red or other spectra that allow a person's eyes to remain adapted to low light or night conditions while still providing enough light for work and safety. Illumination of forest, coastline or beach will be kept to an absolute minimum including the shielding of lights and directing lighting away from the forest or other wildlife habitat.	Avoid and minimize impacts to fruit bats as well as sea turtles in the terrestrial environment.	Pre-C C

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	***Description***	***Impacts Reduced/Avoided***	***Timing Pre-C, C, Ops***
Pre-Construction Surveys for Nesting Mariana Common Moorhens.	For projects within or in the vicinity of suitable moorhen habitat, surveys following the USFWS-approved JRM protocol will be conducted 1 week prior to the onset of work. If nesting Mariana common moorhens are present within the limits of construction, clearing and construction will be postponed until the chicks have fledged. If work stops for more than 1 week, preconstruction surveys will be repeated.	Avoid and minimize impacts to nesting moorhens.	Pre-C C
Protection of Cycads and Special-Status Plant Species.	During construction activities, viable *Cycas micronesica*, *Eugenia bryanii*, *Dendrobium guamense*, *Psychotria malaspinae*, and *Tuberolabium guamense* found within the project boundaries would be translocated to the maximum extent practicable.	Direct impacts to special-status plants.	Pre-C C
Protection of Mariana Eight-spot Butterfly and Host Plants.	Pre-construction butterfly and host plant surveys within suitable habitat within project boundaries. Salvage and translocate host plants, larvae or eggs to the maximum extent practicable.	Avoid and minimize direct impacts to adult, larvae, eggs and host plants of Mariana eight-spot butterfly.	Pre-C C
WETLANDS			
Road and Bridge Design.	• Disturbance to streambeds, wetland soils, and other vegetation will be avoided to the maximum extent practicable. • Pre-cast bridges, especially for long spans, will be used to allow installation with minimal contact with the wetland. • Maintain existing elevations and install retaining walls, as appropriate, to reduce disturbance and side slope fill. • The extent of fill needed on top of a crossing structure will be minimized to the maximum extent practicable by limiting the increase of the road grade as it approaches the crossing point.	Work will be designed and constructed to avoid and minimize impacts to wetlands to the maximum extent practicable.	Pre-C C

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
MARINE BIOLOGICAL RESOURCES			
Implement Engineering Controls during design and construction per Title 22 GAR, Chapter 10 Guam Soil Erosion and Sediment Control Regulations.	• Use drainage diversion and control to direct stormwater flow away from construction sites. • Use benches or terraces and drainage control on cut or fill slopes higher than 15 feet to minimize erosion on slope faces. • Minimize the size of the disturbed area during the construction period. • Plan earth-moving operations for periods of low rainfall. Re-vegetate and permanently stabilize disturbed areas as soon as possible.	These measures reduce potential for exposure of disturbed soil to rainfall and runoff, thus reducing potential for increased erosion of soil by water.	Pre-C C
Erosion Control Plan.	Plan is required before any properties can be cleared and graded. Potential erosion control BMPs may include, but may not be limited to: • Check Dam. • Diversion Dike/Swale. • Level Spreader. • Fiber Rolls. • Vegetated and Lined Waterways. • Rock Outlet Protection. • Erosion Control Blankets. • Stabilization with Vegetation, Sod, Mulch, or Topsoil.	Minimizes potential impacts to soil from erosion by diverting, controlling, and slowing runoff.	Pre-C C Ops
Stormwater Pollution Prevention Plan.	DoD facilities are required to comply with the SWPPP during construction and then during day to day operations, to ensure that stormwater remains free of contaminants. A SWPPP is a self-implementing plan for compliance with the Construction General Permit and an installation's stormwater permit. It requires development of pollution prevention measures, including BMPs, to reduce and control pollutants in stormwater discharge. In addition to the measures listed under the Erosion Control Plan, potential BMPs may include, but may not be limited to: • Perimeter Dike/Swale.	The SWPPP identifies BMPs to address runoff reduction and reduce impacts to soil from erosion.	Pre-C C Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
	• Sediment Basin. • Sediment Trap. • Silt Fence. • Gravel/Sand Bag Berms. • Stabilized Construction Entrance/Exit. • Storm Drainage Inlet Protection. • Straw Bale Dike.		
Manage live-fire ranges in accordance with current Marine Corps range management policies and procedures MCO 3550.10 Policies and Procedures for Range Training Area Management.	Develop range specific standard operating procedures, which may include, but may not be limited to the following: • Employ engineering controls and maintain grassy vegetation on berms. • Manage stormwater at ranges. • Restrict vehicular activities at ranges to designated/previously identified areas. • Conduct monitoring and range clearance (remove expended rounds) of live-fire ranges with impact berms at a minimum of every 5 years (Note: under the REVA Program, fate and transport modeling using site-specific data will be used to determine the appropriate frequency of monitoring and range clearance).	These measures minimize impacts to soil from erosion and potential metals contamination associated with range operations, thereby reducing the potential for soil or sediments to enter nearshore waters.	Ops
Water Quality Monitoring Plan.	Water Quality Monitoring Plan may be required to evaluate the effectiveness of any number of different environmental permits and/or performance standards.	Identifies ambient or control conditions at a particular site and detects deviations from those conditions resulting from a project or operations of a facility.	C
LID.	LID is a design measure that requires the use of innovative methods to capture stormwater that would otherwise flow into nearby watersheds using a combination of retention devices and vegetation to allow stormwater to be retained and managed at the source, rather than relying on downstream efforts to control the flow of water and contaminants. Potential LID measures may include, but may not be limited to: • Stormwater Ponds (Retention/Detention).	Improves the quality of receiving waters and stabilizes flow rates of nearby streams by reducing water pollution and increasing groundwater infiltration.	C Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
	• Stormwater Wetlands. • Infiltration Practices. • Filtering Practices. • Open Channel Practices. • Minimizing Exposure. LID measures would be consistent with guidelines provided in UFC 3-210-10, stormwater management techniques provided in the *CNMI and Guam Stormwater Management Manual*, as amended in 2010, as well as updated guidance in the 2014 *Stormwater Management in the Pacific and Caribbean Islands: A Practitioner's Guide to Implementing LID.*		
Spill Prevention and Response Procedures.	Written procedures for cleaning up spills or leaks, notifying the appropriate personnel, and following the reporting procedures.	Reduce/avoid potential impacts to water resources from spills.	C Ops
Routine Facility Inspections.	Qualified facility personnel must regularly inspect all areas of the facility where industrial materials or activities are exposed to stormwater for ongoing good housekeeping, spill control equipment, and outdoor storage.	Reduce/avoid potential impacts to water resources from spills or release of other contaminants and pollutants.	C Ops
Employee Training.	Training must be given to all employees who work in areas where industrial materials or activities are exposed to stormwater, and must include spill response, good housekeeping, and material management practices.	Reduce/avoid potential impacts to water resources from spills or release of other contaminants and pollutants.	Pre-C C Ops
Road and Bridge Design.	Design measures will place construction work and facilities (including roads) outside of wetlands and other waters of the U.S. to the maximum extent practicable.	Work will be designed and constructed to avoid and minimize impacts to wetlands and other waters of the U.S. to the maximum extent practicable.	Pre-C
Contractor Education Program.	The DON education program to ensure construction contractor personnel are informed of the biological resources in the project area, including special-status species, avoidance measures, and reporting requirements.	Reduces potential for inadvertent impacts due to lack of awareness of resource presence, sensitivities, and protective measures.	Pre-C Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
LFTRC Range Berm Controls.	LFTRC range berms will contain non-invasive herbaceous vegetation, and other engineering controls. Recommended height of an exterior berm is 12 feet, constructed with 1:1 (soil type dependent) sidewall slopes, and a 4-foot-wide flat top. Recommended height of an interior berm is at minimum, 8 feet in height, up to the exterior berm height of 12 feet, with a 1:1 slope (soil type dependent) and a 4-foot wide flat top.	To manage stormwater runoff and control erosion.	C
Lighting Installation.	Lighting will be designed to meet minimum safety, sustainability, anti-terrorism, and force protection requirements. Hooded lights will be used to the maximum extent practicable at all new roads and facilities. Either hooded or "night-adapted" lights will be installed at the LFTRC. Illumination of forest, coastline or beach will be kept to an absolute minimum including the shielding of lights and directing lighting away from coastal habitat.	To avoid and minimize impacts to sea turtles in the marine environment.	C
Implementation of Elements of the AAFB Sea Turtle Management Plan.	The AAFB Sea Turtle Management Plan includes education of recreational users, limited beach access during nesting season, restrict vehicle and all-terrain vehicle usage, and develop a curfew for campers at Tarague Basin.	To avoid and minimize impacts to sea turtles on AAFB and in the nearshore waters from increased visitor usage of Tarague Beach by military and civilian personnel.	Ops
Recreational Buoys.	Installation of recreational buoys (as appropriate) in areas where the proposed action may result in increased, localized recreational use of marine biological resources.	To avoid and minimize impacts to coral and essential fish habitat as a result of increased recreational use.	Ops
CULTURAL RESOURCES			
Orientation Briefs for Incoming Marines.	The DON will conduct initial orientation briefs for all incoming Marine Corps personnel, their families, and contractors dealing with the sensitivity of the historic properties in the area. All Marine Corps personnel and contractors working on Guam will also receive annual briefings. The DON will develop the briefing in consultation with the appropriate SHPO and will provide SHPO with a copy of the final briefing paper.	To reduce the potential for certain types of indirect adverse effects on historic properties (such as an increase in population or visitation in areas where historic properties are located),	Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
	VISUAL RESOURCES		
Installation Appearance Plan.	The new cantonment and family housing will be designed to be consistent with the 2011 Installation Appearance Plan. While the installation will not be accessible to the public, some features will be publicly visible, including the entrance gates, perimeter fencing, peripheral landscaping, and vertical infrastructure (e.g., light posts and water tanks). These features as well as other facilities on the installation will present a united design template, as outlined in the Installation Appearance Plan.	To avoid and minimize visual resource impacts.	Pre-C
	GROUND TRANSPORTATION		
Construction Period/Construction Site Traffic Management Plan.	The DON/DoD and/or its construction manager or general contractor shall meet with the appropriate Guam Department of Public Works to determine traffic management strategies to reduce, to the maximum extent feasible, traffic congestion and the effects of parking demand by construction workers during construction of this project (at all alternative sites) and other nearby projects that could be simultaneously under construction. The DON/DoD and/or its construction manager or general contractor shall develop a construction management plan for review and approval by the Guam Department of Public Works and/or other Guam agencies. The plan shall include at least the following items and requirements: • A set of comprehensive traffic control measures, to be implemented by each construction phase and specific to each construction site, including: scheduling of major truck trips and deliveries to avoid peak traffic hours; detour signs if required; lane closure procedures, signs, cones for drivers, bicycles and pedestrians; and designated construction access routes. • Notification procedures for adjacent property owners (for each construction site) and public safety personnel regarding when major deliveries, detours,	To reduce impacts to traffic during construction. To reduce any adverse effects of construction to existing roadway infrastructure. To minimize the impacts to vehicle circulation and/or access of adjacent properties during construction.	Pre-C C

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
	and lane closures will occur. • Locations of construction staging areas for materials, equipment, and vehicles at an approved location. • A process for responding to, and tracking, complaints pertaining to construction activity. • Provision for accommodation of pedestrian and bicycle flow. • Provision of parking management and spaces for all construction workers to ensure that construction workers do not park in on street spaces. • Any damage to the street caused by heavy equipment, or as a result of this construction, shall be repaired. All damage that is a threat to public health or safety shall be repaired immediately. The street shall be restored to its condition prior to the new construction as established by a designated inspector and/or photo documentation. • Any heavy equipment brought to the construction site shall be transported by truck, where feasible. • No materials or equipment shall be stored on the traveled roadway at any time. • Prior to construction, portable toilet facilities and debris boxes shall be installed on the site, and properly maintained through project completion. • All equipment shall be equipped with mufflers. • Prior to the end of each work day during construction, the general contractor or other subcontractors shall pick up and properly dispose of all litter resulting from or related to the projects, whether located on the property, within the public rights of way, or properties of adjacent or nearby neighbors.		

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
MARINE TRANSPORTATION			
Observation Towers.	Trained observers will scan the SDZ prior to and during live-fire training to ensure that there are no vessels within or approaching the SDZ. If vessels are at risk from operation of the range, use of the range will be suspended until the vessel clears the SDZ area.	Temporarily suspension of operation of the LFTRC reduces the chance of adverse impact on vessels.	Ops
Notice to Mariners.	The U.S. Coast Guard will announce in the Notice to Mariners the proposed schedule for the use of the LFTRC to inform vessel operators of periods of potential usage.	Notice to Mariners will direct vessel operators to navigate clear of the SDZ to avoid potential impacts from use of the LFTRC.	Ops
UTILITIES			
Construction Coordination.	Utility projects would be closely coordinated with utility providers to minimize utility outages and with managers of other construction projects in affected areas to enhance co-ordination and proper sequencing of the various projects, including roadways.	Reduces project delays, overall project costs, and disruption to the public by minimizing duplicative work (such as road paving), project activity overlaps/ interferences, and utility outage number and duration. Also can minimize stop actions during construction by permitting agencies.	Pre-C C
Comply with National Energy Conservation Policy Act (1978), Energy Policy Act (2005), and EO 13221 (2001).	Reduce energy and water consumption through conservation, efficiency, use of Energy Star appliances, building orientation and insulation to reduce energy use, setback thermostats, cool roof technology, solar energy, efficient and/or natural lighting, among others.	Reduced future needs for additional electrical generating capacity; reduced air pollution; reduced use of non-renewable energy sources, reduced potable water demand, reduced wastewater flow and subsequent treatment and disposal costs.	Pre-C Ops
Wastewater Pretreatment Program.	Install and maintain pretreatment systems in facilities generating industrial wastewater in accordance with the JRM Pretreatment Program.	Reduces or avoids introduction of pollutants from industrial sources which may pass through or interfere with wastewater treatment processes or which may contaminate sewage sludge.	C Ops
Solid Waste Recycling/EO 13514 (EO 2009).	Recycle material from municipal solid waste, such as glass, paper, and metals.	Reduces volume of solid waste disposed in landfills, thus reducing over time the cost of waste disposal.	Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	***Description***	***Impacts Reduced/Avoided***	***Timing Pre-C, C, Ops***
LID BMP Operations and Maintenance Inspection Checklist.	Establish a LID BMP O&M Inspection Checklist to be implemented during operations to assess whether appropriate LID measures are designed/sited, properly maintained, monitored, and effective during operations. Any deficiencies would lead to corrective actions.	Impacts to the aquifer and near shore waters reduced through storm water management.	Ops
Comprehensive Waste Management Plan, August 2010 (or any applicable update), and *Integrated Solid Waste Management Plan for DoD Bases, Guam*, February 20, 2013.	Process green waste on-site for reuse (goal of 100%) during construction. Meet 60% diversion rate goal for construction/demolition debris through reuse (including such actions as concrete crushing and reuse as base material and grinding and reuse of asphaltic concrete from roads). Meet goal of 50% diversion rate from disposal for project non-construction/demolition solid waste (not directly generated from materials used for erecting structures).	Reduces volume of project-derived wastes (e.g. construction and demolition debris and green waste) that would otherwise be disposed of at permitted disposal facilities.	C Ops
Periodic maintenance of wastewater systems/ Title 22 Guam GAR, Chapter 12 Individual Wastewater Disposal System Regulations.	Periodically clean temporary toilet facilities and individual sewage disposal systems.	Reduces potential hazards associated with sewage spills and ensures proper treatment and disposal.	C Ops
HAZARDOUS MATERIALS AND WASTE			
Erosion Control Plan.	Potential erosion control BMPs may include, but may not be limited to: • Check Dam. • Diversion Dike/Swale. • Level Spreader. • Fiber Rolls. • Vegetated and Lined Waterways. • Rock Outlet Protection. • Erosion Control Blankets. • Stabilization with Vegetation, Sod, Mulch, or Topsoil.	Eliminates and/or minimizes nonpoint source pollution within Guam's waters from polluting substances carried by sediment.	C Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
Spill Prevention and Response Procedures.	Written procedures for cleaning up spills or leaks, notifying the appropriate personnel, and following the reporting procedures.	Reduce/avoid potential impacts to soil and water resources from spills.	C Ops
Routine Inspections.	Qualified facility personnel must regularly inspect all areas of the facility where hazardous materials and waste are stored for ongoing good housekeeping, record keeping, and spill control equipment.	Reduce/avoid potential impacts to soil and water resources from spills.	C Ops
Employee Training.	Training must be given to all employees who handle hazardous materials and waste, and must include spill response, good housekeeping, record keeping and material management practices.	Reduce/avoid potential impacts to soils and water resources from spills.	Pre-C C Ops
Radon Control Measures.	Radon control measures would be incorporated into facility designs and periodic monitoring would be conducted to ensure that radon levels are within acceptable levels to protect human health.	Reduce/eliminate accumulation of radon gas in structures.	Pre-C Ops
PUBLIC HEALTH AND SAFETY			
Naval Ordnance Safety and Security Activity Instruction 8020.15D.	• At munitions response sites, no site operations may begin unless Naval Ordnance Safety and Security Activity and the DoD Explosive Safety Board have reviewed and approved the Explosives Safety Submission. • Comply with the approved Guam Explosives Safety Submission for on-site construction support where the likelihood of encountering MEC is determined to be moderate or high and where ground-disturbing activities may occur in areas known or suspected to contain UXO.	Reduces the risk to workers and the public from explosive hazards.	C Ops
GCA (10 GCA 36-Mosquito Control) Remove standing water sources and/or promote proper drainage.	• To limit the amount of standing water at construction sites, drain or fill stagnant water pools, puddles, and ditches; remove containers that catch/trap water (e.g., buckets, old tires, cans). • Apply pesticides (e.g., *Bacillus thuringiensis*) to help control mosquitoes.	Reduces the opportunities for an outbreak of water-related diseases.	C Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
Operational Risk Management.	Implement the Operational Risk Management process as outlined in OPNAVINST 3500.39A and MCO 3500.27B. Management measures would include: • Develop and clearly mark SDZs, which determine the restricted land and airspace requirements to laterally and vertically contain projectiles, fragments, debris, and components resulting from the firing of weapons. • Prior to conducting training activities, clear public and non-participating personnel from the training area. • Continually assess LFTRC operations and update/revise safety measures as needed.	Helps prevent hazards to public health from training operations.	Ops
Restrict access to electromagnetic emitters.	• Restrict access to emitters through the use of security fencing, posting warning signs, or locking out unauthorized persons in areas, where practical. • Operate electromagnetic emission sources in accordance with applicable safety standards.	Minimizes the risk of exposure to electromagnetic emissions.	Ops
Construction Health and Safety Program.	Implement a construction health and safety program that complies with federal and local health and safety regulations. Elements of the safety program would include: • Responsibilities of construction workers and subcontractors. • Job site rules and regulations. • Emergency response procedures. • Safety inspections and audits. • Location of medical services and first aid. • Safety meetings, employee training, and hazard communications. • Personal protective equipment. • Standard construction procedures. • Accident investigation and reporting.	Minimizes the risk of construction worker accidents.	Pre-C C

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	***Description***	***Impacts Reduced/Avoided***	***Timing Pre-C, C, Ops***
Occupational Safety and Health Administration guidelines for hearing protection.	• Enforce Operational Safety and Health Administration guidelines for hearing protection for workers. • Exclude the public from entering construction and operation areas.	Reduces the potential for noise effects to workers and the public.	C Ops
Well head protection zone.	• Avoid incompatible development and incompatible land use within well head protection zones during construction and operations.	Reduces the potential for contaminants to be introduced near water wells.	Pre-C C Ops
Compliance with applicable hazardous material and waste regulations.	• Implement Hazardous Materials Management Plans. • Implement Facility Response Plans Implementing Spill Prevention, Control and Countermeasure Plans (i.e., training, spill containment and control procedures, clean up, and notifications). • Implement Hazardous Materials Minimization Plans. • Ensure DoD personnel are trained as to proper container labeling, storage, staging, and transportation requirements for hazardous materials. • Ensure the Defense Reutilization Marketing Office has sufficient hazardous materials storage, transportation, and disposal capacity prior to any expected increases. • Verify compliance with federal, local, and DoD laws and regulations and implement corrective actions as necessary.	Reduces the potential hazards to workers and the general public during handling, storage, transportation, and disposition of hazardous substances.	C Ops

Table 2.8-1. Best Management Practices Incorporated into the Proposed Action to Reduce Impacts

BMP	*Description*	*Impacts Reduced/Avoided*	*Timing Pre-C, C, Ops*
DoD Directive 6055.9 (DoD Ammunition and Explosive Safety Standard	Comply with the approved Guam Explosives Safety Submission that outlines specific measures that would be implemented to ensure the safety of workers and the public. BMPs that would be implemented include: • Have qualified MEC personnel perform surveys to identify and remove potential MEC items prior to the initiation of ground-disturbing activities. • Have MEC personnel supervision during earth-moving activities. • Have MEC personnel provide MEC awareness training to construction personnel involved in grading and excavations in undisturbed areas that have a high probability of MEC.	Reduces the potential hazards related to the exposure to Munitions and Explosives of Concern.	Pre-C C Ops

Legend: AAFB = Andersen Air Force Base; BMPs = best management practices; C = construction; DoD = Department of Defense; DON = Department of the Navy; EO = Executive Order; ERA = Ecological Reserve Area; FAA = Federal Aviation Administration; GAR = Guam Administrative Rules and Regulations; GCA = Guam Code Annotated; HACCP = Hazard Analysis and Critical Control Point; LFTRC = live-fire training range complex; LID = low impact development; MCO = Marine Corps Order; MEC = Munitions and Explosives of Concern; NWF = Northwest Field; Ops = operations; OPNAVINST = Chief of Naval Operations Instruction; Pre-C = pre-construction; SDZ = surface danger zone; SWPPP = Stormwater Pollution Prevention Plan; USACE = U.S. Army Corps of Engineers; USEPA = U.S. Environmental Protection Agency; UXO = unexploded ordinance.

2.9 POTENTIAL MITIGATION MEASURES

In accordance with 40 CFR, Parts 1502.14 and 1502.16, an EIS should include a discussion of measures to mitigate adverse environmental impacts. For this SEIS, potential mitigation measures that are likely to be implemented are discussed in the individual resource sections in Chapters 4 and 5 and summarized at the end of each chapter in Tables 4.7-1 and 5.7-1, respectively. Final mitigation measures will be determined after the completion of consultations with appropriate agencies and will be included in the ROD.

2.9.1 The Economic Adjustment Committee and the Office of Economic Adjustment

EO 12788 (as amended) established the Economic Adjustment Committee (EAC) to (1) advise, assist, and support the Defense Economic Adjustment Program; (2) develop procedures for ensuring that State, regional, and community officials and representatives of organized labor in those States, municipalities, localities, or labor organizations that are substantially and seriously affected by changes in Defense expenditures, realignments or closures, or cancellation or curtailment of major Defense contracts, are notified of available Federal economic adjustment programs; and (3) report annually to the President and then to the Congress on its work during the preceding fiscal year. The EAC comprises 22 federal agencies and offices, and is chaired by the Secretary of Defense or the Secretary's designee. The head of DoD's Office of Economic Adjustment (OEA) serves as the EAC's Executive Director, and the OEA provides all necessary policy and administrative support for the EAC.

Subsection 2822(d) of the National Defense Authorization Act for Fiscal Year 2014 (Pub. L. 113-86) (hereinafter "FY 2014 NDAA") directs the Secretary of Defense to convene the EAC "…to consider assistance, including assistance to support public infrastructure requirements, necessary to support the preferred alternative for the relocation of Marine Corps forces to Guam." In accordance with subsection 2822(d), the EAC will submit a report to the congressional defense committees describing the results of the EAC's deliberations and containing an implementation plan to support the DON's preferred alternative for the relocation of Marine Corps forces to Guam. Since subsection 2822(d) further requires the EAC to submit its report no later than the date of the DON's issuance of the ROD on the proposed action, one of the core mitigation measures identified in this SEIS to address significant impacts to various resources (e.g., nearshore waters, groundwater, wastewater, marine biological resources, sociocultural and cultural resources) relies on the established EAC role coordinating with the Territory of Guam and mobilizing technical experts along with assistance from the OEA. The DON, based upon its close coordination with OEA, anticipates that the EAC implementation plan will include the following (among other content):

- In accordance with the 2011 PA, construction of a Guam Cultural Repository for curation of archaeological collections on Guam.
- Assistance in the development of level 2/3 Centers for Disease Control and Prevention testing capability on Guam, including the construction of a public health laboratory.
- Assistance in the development of Guam civilian water and wastewater infrastructure.

2.9.2 Adaptive Program Management

One notable mitigation measure that is not included in this SEIS is Adaptive Program Management. The decision to implement an Adaptive Program Management mitigation measure in the 2010 ROD was tied to the scope and implementation timeline of the military construction program proposed on Guam. In the ROD, the DON determined that Adaptive Program Management had the potential to avoid and/or reduce

negative impacts, particularly to utility systems, associated with a substantial and short-term peak population increase during construction. Analysis in this SEIS now indicates that such severe short-term peak impacts have been virtually eliminated due to the much slower pace of construction, reduced Marine Corps footprint, and the substantially reduced and more gradual increase in population over the duration of construction and subsequent operation of Marine Corps facilities on Guam. As such, Adaptive Program Management is no longer required. However, the DON believes that there is still continued benefit in the operation of a Civil-Military Coordination Council (CMCC) having the structure, roles, and responsibilities as outlined in the 2010 ROD. The DON remains committed to participating fully in the CMCC and to consider its advice and recommendations in adjusting the pace and/or sequencing of military construction projects.

CHAPTER 3
RESOURCE DEFINITIONS AND APPROACH TO ANALYSIS

This chapter lays the foundation for understanding each of the 18 environmental resources that were analyzed for this SEIS and summarizes the approach taken to evaluate potential impacts to each resource. These same resources were also analyzed in the 2010 Final EIS and much of the summary information presented in this chapter incorporates by reference the more detailed resource descriptions in the 2010 Final EIS. As applicable, this chapter highlights any changes in resource characteristics, regulations, or analytical approach that has occurred since publication of the 2010 Final EIS.

Chapter 3: Resource Definitions and Approach to Analysis

For each of the 18 environmental resources analyzed in this SEIS:

✓ **Definition of Resource**
- Focuses on key resource issues explored in the analyses presented in Chapters 4, 5, 6, and 7
- Highlights information that may have changed or been updated since publication of the 2010 Final EIS

✓ **Regulatory Framework**
- Describes relevant laws and regulations and significance criteria thresholds as applicable
- Highlights applicable regulatory changes that occurred since publication of the 2010 Final EIS

✓ **Approach to Analysis**
- Describes methodology and criteria used to evaluate resource specific impacts
- Highlights any changes in analytical approach that occurred since publication of the 2010 Final EIS
- Summarizes key concerns and issues raised during the scoping process

Each resource is discussed in terms of a definition, the regulatory framework, and the approach to analysis used this SEIS. Each resource definition summarizes key components and characteristics that are explored as appropriate in the environmental consequences sections later in this SEIS (Chapters 4, 5, 6, and 7). The regulatory framework describes the relevant laws and government regulations that pertain to each resource, particularly with regard to identifying impacts to the resource and determining thresholds for significance of those impacts. The approach to analysis describes in general terms the methodology and impact assessment criteria used to identify and categorize resource impacts in this SEIS, and review the key concerns and issues raised about each resource during the two public scoping periods.

3.1 GEOLOGICAL AND SOIL RESOURCES

3.1.1 Definition

The comprehensive description of the geological and soil resources of Guam in this SEIS is the same as that provided in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.1: Affected Environment, pages 3-1 to 3-30). This SEIS includes any relevant geological or soils resources information that may have changed or been updated since the 2010 Final EIS was completed.

3.1.1.1 Geological Setting of Guam

Guam is located on a volcanic arc adjacent to the Mariana subduction boundary and comprises a volcanic core partially overlain with limestone (karst). The entire island is a potentially active seismic area. Geologic hazards on Guam include the potential for earthquakes that can cause liquefaction (loss of soil cohesiveness and stability in response to earthquake ground motion) and tsunamis; regional volcanism; steep slopes where landslides can occur due to earthquakes or heavy rainfall; and sinkholes associated with the limestone karst. Sinkholes range from a few feet (1 m) to about 75 feet (23 m) deep over most of the limestone plateau on Guam (Tracey *et al.* 1964). Other characteristics of the limestone plateau (related to its tendency to be dissolved by groundwater and rainwater) are enclosed depressions that may be up to a 0.5 mile wide (0.8 km) and 40 to 50 feet (12 to 15 m) deep (Tracey *et al.* 1964).

3.1.2 Regulatory Framework

The National Coastal Zone Management Program is a voluntary partnership between the federal government and U.S. coastal states and territories and Great Lakes states authorized by the Coastal Zone Management Act (16 USC §§ 1451 *et seq.*) to address national coastal issues. Federal consistency is a unique aspect of coastal zone management under the Act that ensures that federal actions with reasonably foreseeable effects on coastal uses and resources must be consistent with the enforceable policies of a state's or territory's National Oceanic and Atmospheric Administration (NOAA)-approved coastal management program. This also applies to federally authorized and funded non-federal actions. NOAA approved Guam's Coastal Management Program in 1979 (NOAA 2014). The Guam Coastal Management Program requires consistency with its Erosion and Siltation development policy for applicable federal activities on Guam. The policy states that "development shall be limited in areas of 15% or greater slope by requiring strict compliance with erosion, sedimentation, and land use regulations, as well as other related land use guidelines for such areas." The laws and regulations that follow describe the networked management framework that all non-exempted federal actions, including the proposed actions, must be consistent with to the maximum extent practicable as required by the Coastal Zone Management Act. GEPA administers portions of federal statutes via a Memorandum of Agreement with the USEPA Region 9. GEPA issues Clearing, Grubbing, Grading, and Stockpiling Permits under the Guam Soil Erosion and Sediment Control Regulations (22 Guam Administrative Rules and Regulations [GAR] Chapter 10). In addition to compliance with the USEPA NPDES program, federal projects must also comply with local requirements (e.g., "respecting the control and abatement of water pollution") per Section 313(a) of the Clean Water Act (CWA).

Environmental Protection Plans (EPPs) are specifically identified in 22 GAR, Division II, Chapter 10, § 10103.C.5 (d). EPPs would include nonpoint source control management measures including but not limited to erosion and sedimentation control and fugitive dust control, as necessary, depending on the work, project, activity, and facility function.

Section 10106F of 22 GAR Chapter 10 prohibits earth-moving within sinkholes that threaten their viability, function, or the conveyance of surface water into such features. Modifications or use of sinkholes must be authorized by GEPA and must include an assessment to ensure adverse effects to sinkholes do not occur. Section 3406 of 18 GAR, Chapter 3, Article 4, *Standards for Flood Hazard Area Management* specify measures that are applicable to managing activities that are located in areas subject to flooding hazards or may increase the severity of flooding. Flooding includes tsunamis and storm surge, overflow from rivers and streams, and excessive ponding of storm water within sinkholes. Although permitting under the Flood Hazard regulation is not likely to apply to federal activities outside local jurisdiction, consistency to the greatest extent practicable with regulatory performance standards is required by the Coastal Zone Management Act. Laws, regulations, and design criteria respecting the control of water pollution applicable to floodplains are discussed in the Water Resources regulatory framework.

Structural design and facility function considerations related to geological and soil resources include potential mitigation of geologic hazards. For example, seismic, liquefaction, and ground shaking effects are reduced by following UFC 3-310-04, which specifies DoD requirements for earthquake-resistant designs for new buildings, and evaluating and rehabilitating existing buildings for earthquake resistance.

3.1.3 Approach to Analysis

3.1.3.1 Methodology

The methodology used for identifying and evaluating impacts to geology and soil resources in this SEIS is consistent with the methodology described in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.2: Environmental Consequences, pages 3-31 to 3-32), and includes consideration of available geologic and soil studies, federal laws and regulations, state and local building codes and grading ordinances, and previously published NEPA documents containing relevant information. An indispensable resource for this analysis was an inventory of closed-contour depressions and known karst formations on Guam: UoG Water and Environmental Research Institute of the Western Pacific (WERI) Technical Report No. 112 (Taborosi 2006). Additionally, Light Detection and Ranging contour data were used to identify potential sinkholes on proposed sites. Analyses of topography, soil, and vegetation were considered during site characterization and planning of the proposed action using Light Detection and Ranging contour data, geotechnical reports, and site visits in an effort to minimize impacts to geological and soil resources during the design of the proposed action. The construction and operational footprints of the proposed action include areas not identified in the 2010 Final EIS. The analysis of potential impacts to geology and soils considers both direct and indirect impacts. Direct impacts result from physical soil disturbances or topographic alterations, while indirect impacts include risks to individuals from geologic hazards, as well as impacts to water or marine biological resources away from the construction/operation site.

3.1.3.2 Impact Assessment Criteria

The impact assessment for geological and soil resources considered the following:

- Substantial alteration of surrounding landscape.
- Effects on important geologic features (including large-scale soil or rock removal).
- Filling sinkholes that adversely effects site drainage.
- Diminished slope stability.
- A change to soil and/or bedrock conditions that increases vulnerability to a geologic hazard (e.g., seismic activity, flood, tsunami, liquefaction), and the probability that such a hazard could result in injury and property damage.
- Physical disturbance that substantially increases the rate of erosion and soil loss.
- Reduced amounts of productive soils.
- Threats of pollution to soil or groundwater.

Quantitative thresholds for impact assessment criteria are not available for most components of geological and soil resources analysis. Therefore, the significance of potential project impacts was evaluated subjectively based on the degree of project-induced change in a particular factor relative to existing conditions, as well as by regulatory standards where applicable. Quantitative thresholds for significance exist for other impacts indirectly related to geology and soils. For example, numerical limits (usually in parts per million [ppm]) for petroleum constituents that may enter soil or groundwater. Potential impacts of this nature, indirectly related to geology and soils, are evaluated in the Hazardous Materials and Waste and Water Resources sections in Chapters 4 and 5 of this SEIS.

3.1.3.3 Public Scoping Issues

The scoping comments/concerns regarding geology and soil resources are summarized as follows:

- Implementing erosion control measures for construction and post construction phases.
- Implementing stormwater runoff measures for range complex operations.
- Concerns about fire hazard associated with training range operations and potential destructive effect of fire on vegetation and soils at NAVMAG. Fire damage to NAVMAG vegetation and surface soils could lead to increased erosion in the NAVMAG Fena Valley reservoir watershed and corresponding decreases in the reservoir water quality.
- Ensuring that excavated material is checked for debris, invasive species, contaminants, hazardous waste or materials, and handled accordingly.
- Ensuring that proper permitting and local government clearances are sought where applicable.
- Descriptions of earth movement locations, sources, storage, and volumes.

3.2 WATER RESOURCES

3.2.1 Definition

The comprehensive description of Guam's water resources in this SEIS is the same as that provided in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.1: Affected Environment, pages 4-1 to 4-73). The water resources discussion in this SEIS is divided into the following subcategories: surface water, groundwater, nearshore waters, and wetlands. This SEIS includes any relevant water resources information that may have changed or been updated since the 2010 Final EIS was completed.

3.2.1.1 Surface Water

The discussion of surface water resources incorporates the analysis of both surface water and floodplains. Surface water is primarily found in the rivers and streams of the central and southern portion of Guam where low-permeability volcanic soils contribute to runoff. Few natural surface waters are found in the northern portion of Guam where highly permeable soils occur.

3.2.1.2 Groundwater

The primary source of groundwater (and potable water) on Guam is found in the limestone formations that predominate in the northern portion of the island.

3.2.1.3 Nearshore Waters

For the purposes of this analysis, nearshore waters include all coastal waters having a salinity greater than 0.5 parts per thousand and a depth less than 60 feet (18 m) (from the mean low water mark) and protected under the Guam Coastal Management Program.

3.2.1.4 Wetlands

Wetlands are habitats that are subject to permanent or periodic inundation or prolonged soil saturation including marshes, swamps, and similar areas. Areas described and mapped as wetland communities may also contain small streams or shallow ponds or pond or lake edges.

3.2.2 Regulatory Framework

Laws and regulations that apply to water resources on Guam are described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.1.1: Definition of Resource, pages 4-1 to 4-25). These laws and regulations are listed below with a brief summary. Updates to any of the regulations or any new regulations are also provided below.

3.2.2.1 Surface Water

Federal Laws, Regulations, and Executive Orders

Clean Water Act

The purpose of the CWA is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Under Section 404 of the CWA, the U.S. Army Corps of Engineers (USACE) authorizes discharges of dredged or fill material in waters of the U.S. through a permit program.

Construction General Permit. Construction activities on Guam that might discharge or are proposed to discharge into the island's surface waters (i.e., waters of the U.S.) must obtain coverage under a USEPA Construction General Permit. Specifically, construction activities that disturb one or more acres of land, including smaller sites that are part of a larger common plan disturbing one or more acres of land would need to file an NOI to seek coverage under Construction General Permit and prepare a Stormwater Pollution Prevention Plan (SWPPP). A new Construction General Permit was issued on February 2012 and is valid through February 2017 (USEPA 2012). In compliance with seeking coverage under the Construction General Permit, the project would meet Criterion E in demonstrating compliance with the ESA (as described in Appendix D of the 2012 Construction General Permit [USEPA 2012]).

Municipal Separate Stormwater Sewer Systems. In 2011, the USEPA recommended designation of the stormwater discharges from all Municipal Separate Stormwater Sewer Systems on Guam for NPDES permit coverage. This would require the DoD to prepare and implement Stormwater Management Plans (SWMPs) in compliance with Section 402 of the CWA.

Energy Independence and Security Act of 2007

Section 438 of the Energy Independence and Security Act (EISA) establishes strict stormwater runoff requirements for federal development and redevelopment projects. The intent of Section 438 is to require federal agencies to develop and redevelop applicable facilities in a manner that maintains or restores pre-development stormwater runoff to the maximum extent technically feasible. The provision reads as follows: "Stormwater runoff requirements for federal development projects. The sponsor of any development or redevelopment project involving a federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow."

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 USC § 662) requires consideration of the effects of a federal action on wetlands and areas affecting streams (including floodplains), as well as other protected habitats. Federal agencies must consult with the USFWS and the appropriate state agency with jurisdiction over wildlife resources prior to issuing permits or undertaking actions involving the modification of any body of water (including impoundment, diversion, deepening, or otherwise controlled or modified for any purpose).

Coastal Zone Management Act

The National Coastal Zone Management Program is a voluntary partnership between the federal government and U.S. coastal states and territories and Great Lakes states authorized by the Coastal Zone Management Act to address national coastal issues. Federal consistency is a unique aspect of coastal zone management under the Act that ensures that federal actions with reasonably foreseeable effects on coastal uses and resources must be consistent with the enforceable policies of a state's or territory's NOAA-approved coastal management program. This also applies to federally authorized and funded non-federal actions. NOAA approved Guam's Coastal Management Program in 1979 (NOAA 2014). The Guam Coastal Management Policy on Water Quality states that "Safe drinking water shall be assured and aquatic recreation sites shall be protected through the regulation of uses and discharges that pose a pollution threat to Guam's waters, particularly in estuaries, reef and aquifer areas." The entire island of Guam is classified as a coastal zone under the Coastal Zone Management Act, excluding lands solely under federal jurisdiction.

Executive Order 13514: Federal Leadership in Environmental, Energy, and Economic Performance

This EO calls upon all federal agencies to "lead by example" to address a wide range of environmental issues, including stormwater runoff. Section 14 of this order states that the USEPA, in coordination with other federal agencies, would issue appropriate guidance on the implementation of EISA Section 438 within 60 days.

The USEPA issued its Technical Guidance in December of 2009, recommending that projects minimize hydrologic impacts during construction by implementing green infrastructure or Low Impact Development (LID) techniques that are designed to either (1) retain the 95th percentile storm on-site, or (2) maintain pre-development runoff conditions through site-specific hydrologic analysis. In response to this, DoD issued guidance on January 19, 2010 by releasing the Memorandum for the Acting Assistant Secretary of the Army, Navy, and Air Force under the subject heading "DoD Implementation of Storm Water Requirements under Section 438 of the EISA." This DoD Policy states that "The overall design objective for each project is to maintain pre-development hydrology and prevent any net increase in storm water runoff." The design guidance further states that if this design objective cannot be met within the project footprint, LID measures may be applied at nearby locations on DoD land. If the entire LID volume cannot be accommodated in a development or project area, use of neighboring development (non-DoD) areas could be considered, provided that the design is approved by the Navy and drainage and space requirements can be coordinated.

Executive Order 11988: Floodplain Management

This EO requires that federal agencies take action to reduce the risk of flood loss and restore and preserve the values of floodplains. To minimize the risk of damage associated with these areas, EO 11988 was issued to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct or indirect support of floodplain development wherever there is a practical alternative. EO 11988 outlines different requirements for federal projects located in 100-year and 500-year floodplains (i.e., that area which has a 1% or greater chance or 0.2% or greater chance, respectively, of flooding in any given year).

Guam Regulations and Guam Federal Regulation Implementation

Guam Soil Erosion and Sedimentation Control Regulations/Permits

Clearing, grading, and stockpiling permits are issued directly by GEPA for federal activities while the Guam Department of Public Works (GDPW) issues the same permit for public and private development as part of its building permit system. For most clearing and/or grading permits, there must be an accompanying Erosion Control Plan to specify enforceable measures to maintain water quality in the affected surface water and/or groundwater resource. The regulations also require use of the 2006 *CNMI Guam Stormwater Management Manual* as a design reference (for facilities and roadways) and include stormwater performance standards that are intended to complement federal requirements.

Guam Water Quality Standards

The Guam Water Quality Standards aim to conserve, protect, maintain, and improve the quality of Guam's waters.

National Pollutant Discharge Elimination System (Guam Implementation)

NPDES is a federal permit for all stormwater and other point source pollution discharges. GEPA assists in the administration of these permits and reviews and certifies (401 Water Quality Certification) the permit for compliance with all local regulations and policies and in accordance with the Guam Water Quality Standards.

Pollution Discharge and Operating Permit

For discharges similar to those covered by the NPDES permit, GEPA may require a GovGuam Pollution Discharge Permit. This permit may be issued for any number of liquid, gaseous, solid, or thermal discharges to Territorial waters that fall below the minimum criteria defined in the federal CWA.

Test Boring and Dewatering Permit

Individuals conducting soil test boring and measurements activities may be required to obtain a GEPA Test Boring Permit. Test boring activities include drilling and excavations deeper than 6 feet (2 m) deep for a number of soil and structural engineering analysis work. In addition, if the water table is encountered during excavation work for building foundations and similar construction activities, a Dewatering Permit may be required to control and treat water pumped from the excavation prior to final discharge. Dewatering permits may apply to dredging operations as well.

Clean Water Act Section 401 Water Quality Certification (Guam Implementation)

CWA Section 401 Water Quality Certification issuance identifies that construction or operation of a proposed project or facility would be conducted in a manner consistent with Guam Water Quality Standards. As part of a Water Quality Certification, an EPP is required. EPPs describe the methods, practices, and equipment to be used on-site; expected or anticipated environmental problems during and after construction; and the methods, practices, and equipment that may be used to avoid, mitigate, or control potential adverse effects on the environment. EPPs are specifically identified in 22 GAR, Division II, Chapter 10, § 10103.C.5(d). For work occurring within or affecting surface waters, a USACE permit applicant must prepare a Water Quality Monitoring Plan that describe measures to maintain Guam Water Quality Standards. These measures typically include procedures for monitoring, corrective actions, reporting, and recordkeeping. The local requirement for a Water Quality Monitoring Plan is usually incorporated by the USACE or GEPA in their permit programs regulating activities affecting surface water or wetlands.

3.2.2.2 Groundwater

Federal Regulations

The federal regulations described under *Surface Water* in this SEIS that also apply to groundwater are listed below along with other applicable requirements.

- CWA
- Coastal Zone Management Act

Safe Drinking Water Act

The Safe Drinking Water Act regulates the nation's drinking water supplies by establishing standards for drinking water to protect against both naturally occurring and man-made contaminants. This act also seeks to prevent contamination of drinking water resources by establishing requirements under programs such as the underground injection control program.

Surface Water Treatment Rule

The Surface Water Treatment Rule seeks to prevent waterborne diseases caused by viruses, *Legionella*, *Cryptosporidum,* and *Giardia lamblia*. These disease-causing microbes are present at varying concentrations in most surface waters. The rule requires that water systems filter and disinfect water from surface water sources to reduce the occurrence of unsafe levels of these microbes. Where groundwater wells are determined to be under the direct influence of surface water, those wells are subject to Surface Water Treatment Rule requirements for treatment technique and monitoring. The GEPA currently requires chemical disinfection at all groundwater wells to address potential microbial contamination, which is more stringent than federal requirements.

Underground Injection Control

The Underground Injection Control (UIC) Program is responsible for regulating the construction, operation, permitting, and closure of injection wells that place fluids underground for storage or disposal. UIC Permits are required where surface runoff is disposed to underground injection wells or to sinkholes that may be subject to UIC regulations.

Groundwater Rule

The Groundwater Rule (40 CFR Parts 9, 141 and 142) provides for increased protection against microbial contamination. This is a risk-based rule that requires groundwater used by public drinking water systems be disinfected if indicator bacteria are detected in it.

Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks

This regulation (40 CFR Chapter 1, Part 280) protects groundwater by establishing regulations and procedures for underground storage tanks that contain regulated substances such as petroleum products.

Guam Regulations

Guam Safe Drinking Water Act, Water Resources Conservation Act, and Water Pollution Control Act

The Guam Safe Drinking Water Act, Title 10 Guam Code Annotated (GCA), Chapter 53, § 53104, the Water Resources Conservation Act, Title 10 GCA, Chapter 45, Title 10, and the Water Pollution Control Act, 10 GCA, Chapter 47, § 47104 authorize the GEPA to regulate activities respecting the protection of wellhead areas, public water systems dependent on groundwater sources, and underground injection. The

main implementing regulations include the Guam Primary and Secondary Drinking Water Regulations and related wellhead protection requirements under the Guam Water Resource Development and Operating Regulations.

3.2.2.3 Nearshore Waters

Federal Regulations

The federal regulations described under *Surface Water* in this SEIS that also apply to nearshore waters are listed below.

- CWA
- Fish and Wildlife Coordination Act
- Coastal Zone Management Act

Guam Regulations

The Guam regulations described under *Surface Water* in this SEIS that also apply to nearshore waters are listed below along with other applicable requirements.

- Guam Soil Erosion and Sedimentation Control Regulations/Permits
- Guam Water Quality Standards
- Pollution Discharge and Operating Permit
- Test Boring and Dewatering Permit

Coastal Nonpoint Source Pollution Control Program

The Coastal Nonpoint Source Pollution Control Program (Section 6217) addresses nonpoint pollution problems in coastal waters. Section 6217 requires the 29 states and territories with approved Coastal Zone Management Programs to develop Coastal Nonpoint Pollution Control Programs. In its program, a state or territory describes how it will implement nonpoint source pollution controls, known as management measures, that conform to those described in Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters. This program is administered jointly with NOAA.

3.2.2.4 Wetlands

Federal Regulations

The federal regulations described under *Surface Water* in this SEIS that also apply to wetlands are listed below along with other applicable requirements.

- CWA
- Fish and Wildlife Coordination Act

Executive Order 11990: Wetlands Protection

This EO requires that governmental agencies, in carrying out their responsibilities, provide leadership and "take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands." Each agency is to consider factors relevant to a proposed project's effect on the survival and quality of wetlands. Among these factors is the maintenance of natural systems, including conservation and long-term productivity of existing flora and fauna, species and habitat diversity and stability, hydrologic utility, fish, and wildlife. If no practical alternative can be demonstrated, agencies are required to provide for early public review of any plans or proposals for new construction in wetlands.

Guam Regulations

Wetlands, 21 Guam Code Annotated 60101

Real Property requirement implemented by 18 GAR - Land Management, Chapter 3 - Territorial Planning Commission, Article 5 - Wetland Areas. The purpose of these regulations is to establish procedural guidelines and performance standards for development and conservation, mapping and identification of wetland areas pursuant to EOs No. 78-21 and 90-13 (Protection of Wetlands). These regulations apply to those land and water areas delineated as Wetland Areas of Particular Concern on an official map of wetlands as approved by the Guam Land Use Commission.

3.2.3 Approach to Analysis

3.2.3.1 Methodology

The methodology used for water resources analysis is described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.1.1: Methodology, pages 4-73 to 4-81). The methodology for identifying, evaluating, and mitigating impacts to water resources has been established based on federal and GovGuam laws and regulations as identified in Section 3.2.2.

The environmental consequences evaluation for water resources includes a qualitative and quantitative analysis of surface water, groundwater, nearshore waters, and wetlands/waters of the U.S. to the extent possible given available project data. Environmental impact assessments were made and compared to baseline conditions, items of public concern, and impact assessment criteria to determine the magnitude of potential impacts to water resources. The water resources analysis is separated into two main phases: construction and operations. The analysis of potential impacts considers direct and indirect impacts during both construction and operation. Direct impacts are those that may occur during the construction phase of the project and cease when the project is complete (i.e., grading, excavation, fill) or those that may occur as a result of project operations following the completion of construction (i.e., increased runoff due to impervious areas, increased groundwater pumping, increased discharge of wastewater). Indirect impacts are those that may occur as a result of the completed project or those that may occur during operations but not as a direct result of construction or operational activities.

In evaluating environmental consequences for water resources, it is assumed that the proposed action would continue to meet sustainability requirements and goals as described in the 2010 Final EIS and Chapter 8.6 of this SEIS. These include:

- Pursuing and facilitating Leadership in Energy and Environmental Design (LEED) Silver certification for DON facilities.
- Implementing LID features in accordance with the DoD UFC LID (UFC 3-210-10) and § 438 of the EISA.
- Using BMPs to avoid, minimize, or reduce/eliminate potential impacts in compliance with local, state, or federal regulations to protect the environment.

3.2.3.2 Impact Assessment Criteria

The following factors are considered in evaluating impacts to water resources:

- Reducing availability or accessibility of water resources.
- Noncompliance with all applicable water quality standards, laws, and regulations.
- Increasing risk associated with environmental hazards or human health.
- Decreasing existing and/or future beneficial use.

- Increasing risk of flooding.
- Depletion, recharge, or contamination of a usable groundwater aquifer for municipal, private, or agricultural purposes.
- Reducing the amount of wetlands available for human use or ecological services.
- Long-term increased inundation, sedimentation, and/or degradation to the quality of a water resource.

If an activity is deemed as having an impact, the activity then can be evaluated to determine if the impact is significant or less than significant. For a significant impact, a determination is made as to whether the impact can be mitigated to less than significant.

The criteria used for determining significance of impacts to surface water, groundwater, nearshore waters, and wetlands are provided in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.1.2: Determination of Significance, pages 4-81 to 4-83), and are briefly summarized below.

Surface Water

Surface water issues include water quality, flooding, and flow path alterations. Surface water quality impacts are evaluated by examining the potential increase of contamination during construction and operations including chemicals, heavy metals, nutrients, and/or sediments in the surface water and stormwater runoff as a result of the proposed action. Potential impacts to surface water quantity and velocity during construction and operations are analyzed by examining changes in drainage volumes and patterns associated with alterations to soils/groundcover and increased impervious area.

Groundwater

Groundwater impact concerns include water quality and water quantity. Potential groundwater impacts associated with construction activities include spills, leaks, and sedimentation having direct impacts to stormwater runoff that can contribute to groundwater contamination, as well as direct contamination of groundwater resources through percolation. The possible impacts connected with operational activities include increases of impervious areas, increased pumping rates, contamination from recharge or over pumping.

Nearshore Waters

The nearshore water impact analysis focuses on water quality. The potential increases of contamination during construction and operations include chemicals, heavy metals, nutrients, and/or sediments in nearshore waters as a result of an increase in stormwater discharge or point source discharges to the nearshore waters such as wastewater effluent.

Wetlands

The wetland impacted areas of concern include pollutants, loss of area, and loss of functionality. The effects associated with construction and operations include an increase in potential spills and leaks from hazardous materials that may be stored in close proximity to designated wetlands. An indirect impact to existing wetlands may occur by altering (i.e., diverting or restricting) the surface water flowing into the wetlands. Loss of wetland area would occur if the proposed action involves the direct fill/excavation of wetlands. Loss of functionality can also occur if construction operations occur directly within the designated wetlands.

3.2.3.3 Public Scoping Issues

The scoping comments/concerns regarding water resources are summarized as follows:

- Explain how proposed new and increased discharges to impaired waters would not exceed total maximum daily load (TMDL) waste load allocations or further contribute to water quality exceedances, how the proposed project would coordinate with ongoing protection efforts, and any potential mitigation measures that may be implemented to avoid further degradation of impaired waters.
- Identify and quantify all wetlands and waters of the U.S. within the study area and how they would be affected by project alternatives.
- Identify the need for a Section 404 permit to discharge dredged or fill material into waters of the U.S. and include an evaluation of the project alternatives in this context in order to demonstrate the project's compliance with the 404(b)(1) guidelines (i.e., any alternative subject to Section 404 requirements that is carried forward must be the Least Environmentally Damaging Practicable Alternative [LEDPA]).
- Discuss cumulative impacts from climate change on water quality and identify potential mitigation measures, as appropriate, to protect the waters of Guam and to ensure water quality standards are met.
- Update existing conditions description of Fena Valley Reservoir and analyze potential impacts due to contamination from munitions constituents (MCs), lead, sediment, and other pollutants.
- Analyze impacts to groundwater quality of the NGLA and utilize the groundwater model being developed to assess the capacity of the NGLA to support potable water demand of the project and Guam.

3.3 AIR QUALITY

3.3.1 Definition

Guam's air quality is described in detail in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.1: Affected Environment, pages 5-1 to 5-14). Air quality is defined by ambient air concentrations of specific pollutants of concern with respect to the health and welfare of the general public. The region of influence (ROI) for air quality includes both the broader island-wide area and specific parcels of land that are sensitive to air quality effects as a result of implementing the proposed action. Air quality can be affected by air pollutants produced by mobile sources (such as vehicular traffic, aircraft, or non-road equipment used for construction activities), and by fixed or immobile facilities, referred to as "stationary sources." Stationary sources can include combustion and industrial stacks and exhaust vents. Potential air quality effects on Guam would occur from both construction and operational activities associated with implementation of the proposed action.

3.3.2 Regulatory Framework

The regulatory framework for air quality includes:

- National Ambient Air Quality Standards (NAAQS) for criteria pollutants.
- Regulations applicable to air toxics particularly on primary mobile source air toxics (MSAT).
- The Clean Air Act (CAA) nonattainment area designation in Guam, as well as associated CAA conformity rule requirements.

- Regulatory programs, guidelines, and planning tools applicable to stationary and mobile sources, as well as greenhouse gases and associated climate effects.

Based on proposed alternatives affecting Guam's coastal air quality, the Coastal Zone Management Act requires that activities be consistent, to the maximum extent practicable, with the Guam Coastal Management Policy on Air Quality, which states that "All activities and uses shall comply with all local air pollution regulations and all appropriate federal air quality standards in order to ensure the maintenance of Guam's relatively high air quality." The regulatory framework and associated regulations remain essentially unchanged from the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.1.1.1 Regulatory Overview, pages 5-1 to 5-9). Some revisions to the NAAQS and new air quality planning tools are described below.

3.3.2.1 National Ambient Air Quality Standards Revisions

On June 22, 2010, the USEPA issued a final rule effective on August 23, 2010 updating the NAAQS for sulfur dioxide (SO_2) (75 FR 35520, June 22, 2010). The USEPA revised the primary SO_2 NAAQS to provide requisite protection of public health with an adequate margin of safety by establishing a new 1-hour SO_2 standard at a level of 75 parts per billion (ppb), which is based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations. The USEPA also revoked both previously existing 24-hour and annual primary SO_2 standards.

On January 15, 2013, the USEPA issued a final rule effective on March 18, 2013 updating the NAAQS for fine particle pollution (particulate matter less than or equal to 2.5 microns in diameter [$PM_{2.5}$]) (78 FR 3086, January 15, 2013). The USEPA revised the annual $PM_{2.5}$ primary standard by lowering the level from 15.0 to 12.0 micrograms per cubic meter ($\mu g/m^3$). The primary standards were established to protect human health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. A description of the criteria pollutants and associated health and environmental impacts is available in the 2010 Final EIS (Volume 9, Appendix I: Section 2.1, pages I-3 to I-6). The lower standard provides increased protection against health effects associated with long- and short-term exposures, including premature mortality, increased hospital admissions and emergency department visits, and development of chronic respiratory diseases. The 24-hour $PM_{2.5}$ primary standard is being retained at a level of 35 $\mu g/m^3$. The USEPA is revising the Air Quality Index for $PM_{2.5}$ to be consistent with the final primary $PM_{2.5}$ standards. With regard to the primary standard for coarse particles (particulate matter less than or equal to 10 microns in diameter [PM_{10}]), the USEPA is retaining the current 24-hour PM_{10} standard of 150 $\mu g/m^3$. There is no annual standard for PM_{10}.

The USEPA is retaining the current suite of secondary NAAQS, which set limits to protect the environment from adverse effects associated with pollutants. These standards include the 24-hour and annual $PM_{2.5}$ standards, as well as the 24-hour PM_{10} standard. Non-visibility welfare effects are addressed by this suite of secondary standards, and particulate matter (PM)-related visibility impairment is addressed by the secondary 24-hour $PM_{2.5}$ standard. The updated NAAQS are summarized in Table 3.3.2-1.

Table 3.3.2-1. National Ambient Air Quality Standards for Criteria Pollutants

Pollutant		*Primary/Secondary*	*Averaging Time*	*Level*	*Form*
Carbon Monoxide		Primary	8-hour	9 ppm	Not to be exceeded more than once per year.
			1-hour	35 ppm	
Lead		Primary and Secondary	Rolling 3-month average	0.15 µg/m[(1)]	Not to be exceeded.
Nitrogen Dioxide		Primary	1-hour	100 ppb	98th percentile, averaged over 3 years.
		Primary and Secondary	Annual	53 ppb[(2)]	Annual mean.
Ozone		Primary and Secondary	8-hour	0.075 ppm[(3)]	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.
Particle Pollution	$PM_{2.5}$	Primary	Annual	12 µg/m[(3) (4)]	Annual mean, averaged over 3 years.
		Secondary	Annual	15 µg/m[(3)]	Annual mean, averaged over 3 years.
		Primary and Secondary	24-hour	35 µg/m[(3)]	98th percentile, averaged over 3 years.
	PM_{10}	Primary and Secondary	24-hour	150 µg/m[(3)]	Not to be exceeded more than once per year on average over 3 years.
Sulfur Dioxide		Primary	1-hour	75 ppb[(5)]	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year.

Notes (as of May 2013):

(1) Final rule signed October 15, 2008 and effective on January 12, 2009. The 1978 lead standard (1.5 µg/m^3 as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

(2) The official level of the annual nitrogen dioxide standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of a clearer comparison to the 1-hour standard.

(3) Final rule signed March 12, 2008 and effective on May 27, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, USEPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

(4) Final rule signed January 15, 2013 and effective on March 18, 2013. The primary annual fine particle ($PM_{2.5}$) standard was lowered from 15 to 12 µg/m^3.

(5) Final rule signed June 2, 2010 and effective on June 4, 2012. The 1971 annual and 24-hour SO_2 standards were revoked in that same rulemaking. However, these standards remain in effect until 1 year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

Source: USEPA 2012.

3.3.2.2 Air Quality Planning Tools

The USEPA issued a notice of availability (75 FR Vol. 75, No. 243, December 20, 2010) of the Motor Vehicle Emissions Simulator model (MOVES) for quantitative carbon monoxide (CO) and PM hot-spot analyses. MOVES is the USEPA's state-of-the-art, upgraded model for estimating emissions from cars, trucks, motorcycles, and buses and supersedes the MOBILE6 emission factor model employed in the 2010 Final EIS for project-level motor vehicle related air quality analyses. In the notice, the USEPA also established a 2-year grace period for using MOVES for quantitative hot-spot CO and PM analyses for

project-level conformity determinations. The transportation conformity grace period ended December 20, 2012. Therefore, this SEIS has been updated using MOVES as the appropriate planning tool to quantify motor vehicle emissions and associated air quality effects.

In December 2010, the USEPA also published quantitative analysis guidance for assessing mobile source PM ($PM_{2.5}$ and PM_{10}) hot-spot impacts using MOVES for predicting emission factors (USEPA 2010) in addition to utilizing CAL3QHCR or American Meteorological Society/USEPA Regulatory Model (USEPA 2007) dispersion modeling for predicting PM concentrations at hot-spot locations. Although this guidance was developed to provide a tool to analyze project-level hot-spot PM concentration levels as part of the CAA conformity requirements applicable to nonattainment areas, the methodology provided in the guidance can also be applied within attainment areas to determine whether the PM NAAQS levels would be exceeded at hot-spots, in particular due to concerns regarding potential increases in local diesel truck traffic. This SEIS uses the modeling approach recommended in the guidance to determine hot-spot PM impacts from operations of both on-road vehicles and non-road construction equipment, as a result of the proposed action, and in response to comments received during the public scoping process (see Section 3.3.3.3).

3.3.3 Approach to Analysis

3.3.3.1 Methodology

The approach to the impact analysis, under both construction and operational phases, generally follows the same methods used in the 2010 Final EIS by quantifying annual emissions and ambient concentration dispersion modeling. Air quality modeling and methodology are described in detail in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.2.1.1: Methodology, pages 5-14 to 5-19, and Volume 6, Chapter 7: Air Quality, Section 7.2.1 Approach to Analysis, pages 7-8 to 7-15).

Annual Emissions Forecasts

In the 2010 Final EIS, island-wide criteria pollutants and greenhouse gas annual emissions were predicted for:

- On-road vehicles and on-site equipment associated with construction activities.
- Stationary and mobile sources associated with operational activities including:
  - Facilities related to (1) energy, wastewater treatment and waste disposal upgrade and material; and (2) personnel transport required for cantonment and family housing and training.
  - Training facilities related to firing ranges, non-fire maneuver ranges, and aviation training ranges.
- On-road vehicles.

Annual construction and operational emissions as predicted in the 2010 Final EIS were compared with impact significance levels in terms of total annual emissions from island-wide activities, and were determined to have less than significant air quality impacts. The emissions levels analyzed for this SEIS from facility operations (e.g., power and wastewater treatment), aircraft, and ships are anticipated to be proportionately lower than those analyzed for the 2010 Final EIS because of the following factors:

- Substantial reduction in the number of Marines and dependents to be relocated to Guam.

- Constructing and operating a smaller Marine Corps cantonment/family housing area, a similarly sized LFTRC, and reduced-scale infrastructure requirements to support a reduced number of relocating Marines and dependents.

Therefore, potential air quality impacts in terms of proposed facility operations under this SEIS condition would be less than those described in the 2010 Final EIS, which were less than significant, and do not warrant further analysis, as they would be below the impact assessment criteria discussed in Section 3.3.3.2. The reduced overall operational scale would also result in less operational emissions within the two SO_2 nonattainment areas. Therefore, the operational condition general conformity determination made in the 2010 Final EIS remains valid.

However, on-road vehicle operational hot-spot analysis, as well as construction period emissions and the associated general conformity rule applicability determination for construction activities, were updated in this SEIS because of:

- The upgrade of the on-road mobile source planning tool (i.e., MOVES as compared to MOBILE6).
- The change in baseline local traffic patterns and diesel fuel regulations.
- The revised construction phase planning schedule.

Although construction emissions associated with an affected land parcel would vary among the proposed alternatives, predicted island-wide total air emissions (including carbon dioxide [CO_2]) would be similar for each alternative evaluated in this SEIS.

The annual emissions associated with construction activities were predicted for, and focused on, the preferred alternative that consists of:

- The Finegayan cantonment and family housing alternative (Alternative A) detailed in Chapter 4.
- The NWF LFTRC alternative (Alternative 5) described in Chapter 5.
- Alternative A and Alternative 5 combined, as discussed in Chapter 6.

The predicted island-wide annual construction emissions were compared with the Prevention of Significant Deterioration emissions impact significance threshold (250 tons per year [tpy]) to determine the potential overall attainment pollutant emissions impact significance. The SO_2 emissions within the two nonattainment areas were identified and compared with the 100 tpy *de minimis* (threshold) level to determine the applicability of the general conformity rule.

The same methodologies and analysis tools used for predicting annual emissions in the 2010 Final EIS were also used for this SEIS, with the following exceptions:

- USEPA MOVES model (Version: MOVES2010b) was used to predict on-road vehicles, including trucks and worker's commuting vehicles, during the construction period; in contrast to the MOBILE6 emission factor model used in the 2010 Final EIS that did not.
- Since the publication of the 2010 Final EIS, the GEPA, under the Air Pollution Control Program, has worked closely with businesses and the Guam Legislature to help the island transition from low sulfur diesel to ultra-low sulfur diesel to reduce island-wide air pollutant emissions. The concentration of sulfur in ultra-low sulfur diesel cannot exceed 15 ppm, while low sulfur diesel may contain up to 500 ppm sulfur. The requirement that all diesel fuels sold on Guam must meet ultra-low sulfur diesel quality came into effect on January 1, 2011. This SEIS therefore assumes

ultra-low sulfur diesel fuel usage to estimate on-road vehicle emissions, as compared to low sulfur diesel fuel used to calculate emissions in the 2010 Final EIS. According to the USEPA, the switch to ultra-low sulfur diesel alone can reduce PM emissions by up to 20%. Also, with the use of ultra-low sulfur diesel, the potential emission of sulfur-based pollutants is 97% less than that of low sulfur diesel.

Hot-Spot Concentration Forecasts

Localized hot-spot impact modeling analysis for on-road vehicles, under both construction and operational phases, was updated or supplemented for this SEIS because of the following:

- An on-road mobile source planning tool upgrade (i.e., MOVES as opposed to MOBILE6).
- The available quantitative hot-spot analysis guidelines for mobile source PM.
- The change in baseline local traffic patterns.
- The revised construction phase planning schedule.

Because of the substantially reduced scale of proposed construction, as well as the lower number of relocated Marines and their dependents, emissions would generally be lower under both construction and operational conditions as compared to the 2010 Final EIS. Therefore, the ambient hot-spot analysis focused on the preferred alternative for both on- and off-site construction and operational activities on local concerns in order to provide a quantitative assessment of impact levels that can be directly compared with the concentration-based impact thresholds such as the NAAQS. The on-site impacts were assessed for Alternative A given its large scale activity concentrated around Finegayan cantonment areas where residential land uses are closely located. The off-site construction traffic related hot-spot impacts at congested roadway intersections were assessed based on the available traffic forecasts performed under the combined preferred alternative (i.e., Alternative A and Alternative 5).

The other alternatives are expected to result in similar magnitude of impacts as compared to the preferred alternative and reduced impacts as compared to the No-Action Alternative (corresponding to the preferred alternative evaluated in the 2010 Final EIS). Therefore, the impacts from other alternatives are essentially described in a qualitative way. Some potential worst-case alternatives are discussed below:

- On-site construction activity PM hot-spot impacts - in addition to the preferred Alternative A, on-site construction activity PM hot-spot impact modeling was also conducted for Alternative B, a potentially worse condition given the close proximity of the South Finegayan family housing area (i.e., Alternative B) to some of the off-site receptors along Route 3.
- Off-site hot-spot impacts during the construction period - based on traffic planning analyses conducted using results from the travel demand forecasting, it was determined that the combined preferred alternative (Alternative A and Alternative 5) would result in the highest truck emissions because the majority (approximately 66%) of the total construction-related truck traffic would travel along the furthest routes from the quarries to the cantonment and family housing areas. As such, the impacts analyzed under the preferred alternative also represent the worst-case condition. No off-site hot-spot analysis was considered under other alternatives.
- Off-site hot-spot impacts during the operational period - the alternative with potential to generate the highest vehicle emissions was also considered in the hot-spot analysis. Based on the comparison of on-road vehicle miles travelled, as shown in Table 3.3.2-2, the hot-spot impacts under the Barrigada/NWF Alternative was also conducted quantitatively.

Table 3.3.2-2. Daily Vehicle Miles Travelled in 2030

Analysis Scenario	*Daily Vehicle Miles Travelled*	*Additional Vehicle Miles Travelled Attributable to Project*
2030 Baseline	2,697,073	--
2030 No-Action	3,196,385	499,312
2030 Finegayan/NWF	2,783,084	86,011
2030 AAFB	2,784,255	87,182
2030 Finegayan	2,784,559	87,486
2030 South Finegayan	2,790,464	93,391
2030 Barrigada/Route 15	2,799,756	102,683
2030 Barrigada/NWF	2,800,817	103,744

On-Road Vehicle Carbon Dioxide and Mobile Source Air Toxics Concentrations

The ambient hot-spot concentration levels for CO and MSATs were predicted using CAL3QHC, the same USEPA dispersion model that was used in the 2010 Final EIS (Volume 6, Chapter 7: Air Quality, Section 7.2: Environmental Consequences, MSAT Analysis, Methodology, Utility Stationary Sources, pages 7-4 to 7-8). The CAL3QHC model was used in association with the upgraded emissions factor model, MOVES, as previously described, for operations of on-road vehicles during both the construction and operational phases. The predicted concentration levels were then compared with the NAAQS to determine the potential impact significance.

On-Road Vehicle Particulate Matter Hot-Spot Analysis

The ambient hot-spot concentration levels for PM (PM_{10} and $PM_{2.5}$) were predicted in order to supplement the analysis performed in the 2010 Final EIS based on guidance released by the USEPA in December 2010 (USEPA 2010), after the publication of the July 2010 Final EIS.

A quantitative impact analysis was not conducted for PM in the 2010 Final EIS because of the lack of regulatory guidance on hot-spot refined modeling analysis for PM. In December 2010, after the 2010 Final EIS was completed, the USEPA published quantitative analysis guidance for assessing mobile source PM hot-spot impacts using MOVES for predicting emission factors (USEPA 2010), as well as either CAL3QHCR or American Meteorological Society/USEPA Regulatory Model (USEPA 2007) dispersion modeling tools for predicting concentrations in a nonattainment area. This methodology can also be used to assess on-road mobile source PM impacts.

However, according to additional USEPA guidance, the PM hot-spot quantitative analysis should be performed for transportation projects with significant diesel traffic increases that have the potential to result in exceedances of $PM_{2.5}$ and/or PM_{10} NAAQS. Projects that require a quantitative $PM_{2.5}$ or PM_{10} hot-spot analysis, as defined in 40 CFR § 93.123(b)(1) of the conformity rule, include:

- New highway projects that have a significant number of diesel vehicles, as well as expanded highway projects that have a significant increase in the number of diesel vehicles.
- Projects affecting intersections that are at Level of Service (LOS) D, E, or F with a significant number of diesel vehicles, or those that will change to LOS D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project.
- New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location.
- Expanded bus and rail terminals and transfer points that significantly increase the number of diesel vehicles congregating at a single location.

- Projects in or affecting locations, areas, or categories of sites which are identified in the PM2.5 or PM10 applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

Some examples of projects of local air quality concern that would be covered by 40 CFR § 93.123(b)(1)(i) and (ii) are:

- A project on a new highway or expressway that serves a significant volume of diesel truck traffic (e.g., facilities with greater than 125,000 annual average daily traffic of which 8% or more is diesel truck traffic).
- New exit ramps and other highway facility improvements to connect a highway or expressway to a major freight, bus, or intermodal terminal.
- Expansion of an existing highway or other facility that affects a congested intersection (operated at LOS D, E, or F as described in Table 3.12.3-2 in Section 3.12.3) that has a significant increase in the number of diesel trucks.
- Similar highway projects that involve a significant increase in the number of diesel transit busses and/or diesel trucks.

This SEIS first evaluates the change of diesel traffic component associated with the proposed action to determine whether further refined hot-spot modeling analysis is required, based on the USEPA-defined screening threshold that equates to 10,000 trucks. If a further hot-spot dispersion modeling analysis is warranted, the CAL3QHCR model is the USEPA-refined guideline dispersion model used for modeling mobile source concentrations near congested intersections.

On-Site Construction Equipment and Truck Emission Particulate Matter Concentrations

PM emissions from non-road equipment and truck operations at construction sites where sensitive receptors may be present were modeled to determine the maximum potential adverse effect construction year under the preferred alternative using the updated USEPA PM hot-spot analysis guidance. The USEPA NONROAD and MOVES models were used to predict on-site equipment and truck exhaust PM emission factors, respectively. Roadway surface dust emission factors for PM_{10} were based on the USEPA's AP-42, *Compilation of Air Pollutant Emission Factors* (USEPA 1995). The USEPA-recommended regulatory dispersion model for near-field applications, American Meteorological Society/USEPA Regulatory Model (USEPA 2007), was used for the preferred alternative PM impact analysis at selected construction sites.

The predicted PM concentrations were compared to the NAAQS. Since $PM_{2.5}$ includes fine particles, similar in size to diesel particulates characterized as one of the MSATs, the comparison of predicted $PM_{2.5}$ concentrations and the corresponding NAAQS can also be used as an indicator of the potential impact from diesel particulates resulting from equipment operations to reflect the MSAT impacts in general.

Stationary Source Criteria Pollutant Concentrations

Under this SEIS proposed action, the demand for electrical power at the cantonment/family housing area would be reduced relative to the 2010 Final EIS from an estimated 20 MW to 5.7 MW. As discussed in Chapter 2 of this SEIS, the current generation capacity on Guam is sufficient to support the alternatives of this SEIS. No refurbishing/reconditioning of any combustion turbines would be required. However, with or without the proposed action, the existing power generating facilities may still require some

improvements in the future in order to fully meet recently promulgated USEPA regulations and standards. The GPA is in a process of developing compliance strategies (GPA 2012) through modernizing its existing power facilities, proposing an ambient air monitoring program, and other strategies, to meet the recently promulgated compliance requirements.

Results from a comprehensive concentration dispersion modeling effort using American Meteorological Society/USEPA Regulatory Models of the potentially refurbished combustion turbines with 20 MW power demand were discussed in the 2010 Final EIS (Volume 6, Chapter 7: Air Quality, Section 7.2.1.1: Methodology, Utility Stationary Sources, page 7-10). Because the analysis was conducted based on the maximum permitting capacity for each pollutant for each combustion turbine, the analysis results from major stationary sources would remain the same, regardless of whether the demand for electrical power is 20 MW or 5.7 MW. Moreover, as stated previously, no refurbishing/reconditioning of any combustion turbines would be required under this SEIS condition. Therefore, a supplemental major stationary source impact concentration analysis is not warranted and was not performed for this SEIS.

In addition to the major source combustion turbines, various minor stationary sources, such as heating boilers, emergency generators, and pumps would be constructed as a result of the proposed action (Volume 9, Appendix I, Section: 3.2, pages I-27 to I-32). These sources are typically of small scale and produce negligible emissions, and therefore are unlikely to require air permits. However, if an air permit is determined to be required for a specific minor source during the final design stage, the air permit application will be prepared to ensure that operation of the minor source would be in compliance with all applicable regulations. The source owner is responsible for the permit or permit modification application.

Summary

In summary, the air quality analysis for this SEIS updated or amended the following elements:

Construction

- Annual emissions for criteria pollutants and carbon dioxide for each alternative.
- On-site equipment and vehicle quantitative hot-spot analysis for PM for the preferred alternative and Alternative B, with qualitative analysis for other alternatives.
- On-road vehicle hot-spot quantitative analysis for CO, PM, and MSATs for the preferred alternative; with qualitative analysis for other alternatives.
- On-site equipment and vehicle MSATs qualitative analysis.

Operation

On-road vehicle hot-spot quantitative analysis for CO, PM, and MSATs for the preferred alternative and Alternative D with qualitative analysis for other alternatives.

3.3.3.2 Impact Assessment Criteria

The criteria applied to the assessment of air quality impacts in this SEIS, as summarized in Table 3.3.3-1, are the same as were used in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.2.1.2: Determination of Significance, pages 5-17 to 5-18).

Table 3.3.3-1. Impact Analysis Threshold

Emission Sources	*Measuring Metric*	*Criteria*
Construction		
On-road vehicles	CO hot-spot concentrations	NAAQS
	PM (PM_{10} and $PM_{2.5}$) screening	Overall diesel truck percentage
	PM (PM_{10} and $PM_{2.5}$) hot-spot concentrations, if screening fails	NAAQS
On-site construction equipment and vehicles	PM (PM_{10} and $PM_{2.5}$) hot-spot concentrations	NAAQS
On-road vehicles	MSAT hot-spot concentrations	Health Risk Assessment[a] Incremental carcinogenic risk greater than 10 in a million. Incremental non-carcinogenic hazard index greater than 1.
Construction equipment and vehicles	Criteria pollutant emissions	250 tpy[b] (Prevention of Significant Deterioration major stationary source threshold)
Construction equipment and vehicles and non-major stationary source operation within nonattainment areas, if applicable	SO_2 annual emissions in Piti and Tanguisson nonattainment areas	100 tpy[b] (*de minimis* level)
Construction equipment and vehicles	CO_2 annual emissions	NA
Operation		
On-road vehicles	CO hot-spot concentrations	NAAQS
	PM (PM_{10} and $PM_{2.5}$) screening	Overall diesel truck percentage
	PM (PM_{10} and $PM_{2.5}$) hot-spot concentrations, if screening fails	NAAQS
On-road vehicles	MSAT hot-spot concentrations	Health Risk Assessment [b] Incremental carcinogenic risk greater than 10 in a million. Incremental non-carcinogenic hazard index greater than 1.

Notes: [a] A health risk assessment is not required, but is being performed in the similar way as for the 2010 Final EIS at the request of USEPA.

[b]These impact significance thresholds are considered as *de minimis* levels and are used to make an impact determination from a disclosure comparison with the combined annual emission levels. However, if such levels are exceeded for a specific pollutant, a further formal analysis is considered, when appropriate, in order to make a formal determination of impact significance.

Legend: CO = carbon monoxide; NAAQS = National Ambient Air Quality Standards; PM = particulate matter; SO_2 = sulfur dioxide; CO_2 = carbon dioxide; tpy = tons per year; NA = not applicable.

3.3.3.3 Public Scoping Issues

The scoping comments/concerns regarding air quality are summarized as follows:

- Conformance of SO_2 emissions at the two Guam nonattainment areas in the Guam implementation plan, per CAA general conformity rule requirements.
- Potential increases in emissions from stationary combustion turbine operations.
- Increases in MSAT emissions due to construction and operational mobile source activities, particularly at hot-spots with a significant increase in MSAT emissions in close proximity to residential communities or other sensitive receptors.
- Practices or project elements that would meet the greenhouse gas emissions reduction goal.

3.4 NOISE

3.4.1 Definition

The comprehensive description of the noise environment of Guam in this SEIS is the same as that discussed in detail in the 2010 Final EIS (Volume 2, Chapter 6: Noise, Section 6.1: Affected Environment, pages 6-1 to 6-20). This SEIS includes any relevant noise information that may have changed or been updated since the 2010 Final EIS was completed. The key attributes defining the noise environment are summarized below.

Loudness is the relative measure of the magnitude of a sound and is typically measured in decibels (dB). Decibels are the ratio of the intensity of the sound to a reference intensity based on atmospheric pressure. Noise is unwanted or annoying sound and is not necessarily based on loudness. It comes from both natural and manmade sources. Noise can have adverse effects on physical and psychological health, affect workplace productivity, and degrade quality of life. Further information regarding health effects due to noise are provided in the appendices of the 2010 Final EIS (Volume 9, Appendices, Appendix K: Additional Reports - Noise: Aircraft Noise Study for AAFB, Appendix A, Czech and Kester 2008).

3.4.1.1 Frequency Weighting

The 2010 Final EIS (Volume 2, Chapter 6: Noise, Section 6.1.1: Definition of Resource, pages 6-1 to 6-3) discusses frequency in detail. The most common frequency measures are *A-weighted scale (dBA*) and *C-weighted scale (dBC).* Noise levels from one scale cannot be added or converted mathematically to levels in another weighting scale.

dBA - Noise sources related to transportation (e.g., traffic and aircraft) and small arms firing (up to .50-cal) use dBA.

dBC - This decibel scale measures more of the low-frequency components of noise than does the dBA scale. It is used for evaluating impulse noise and vibrations generated by explosive charges and large-caliber weapons (such as artillery and mortars).

3.4.1.2 Noise Metrics

Because of continuous versus impulsive types of noise, variations in frequency and period of noise exposure, and the fact that the human ear cannot perceive all pitches and frequencies equally well, noise from military operations is measured using noise metrics that reflect different noise characteristics. Common metrics used in this SEIS noise analysis are *Day-Night Average Sound Level (DNL)* and *Equivalent Sound Level (L_{eq}).*

Day-Night Average Sound Level - This metric cannot be measured directly. Rather, it is calculated as the average sound level in decibels with a 10 dB penalty added to the night-time levels (10 p.m. to 7 a.m.). This penalty accounts for the fact that noises at night sound louder because there are usually fewer noises occurring at night so generally night-time noises are more noticeable. The DNL noise metric may be further defined, as appropriate, with a specific, designated time period (e.g., annual average day DNL, average busy month DNL). The USEPA recommends using this metric and most federal agencies use DNL to define their noise environment and apply it as a land use planning tool for predicting areas potentially impacted by noise exposure. Noise levels due to .50 cal or less small arms weapons use the A-weighted scale and are expressed as dB A-weighted DNL (ADNL). Explosives use the dBC and are expressed as dB C-weighted DNL (CDNL).

Equivalent Sound Level - Another way of describing fluctuating sound is to describe the fluctuating sound heard over specific periods as if it had been a steady, unchanging sound. L_{eq} is the constant sound level that, in a given situation and period (e.g., 1 hour, denoted by $L_{eq}(1)$, or 24 hours, denoted as $L_{eq}(24)$), conveys the same sound energy as the actual time-varying sound.

3.4.2 Regulatory Framework

The same noise standards and guidelines described in the 2010 Final EIS (Volume 2, Chapter 6: Noise, Section 6.1.1, Definition of Resource, Noise Standards and Guidelines, pages 6-4 to 6-7) apply to this SEIS. The following is a brief summary of the applicable noise standards and guidelines.

Construction Noise - Generally, noise resulting from construction activities usually lasts only during daylight hours for approximately 8 hours per day and occurs during the period of time when the construction activities are in the vicinity of the receptors. Construction noise ends upon completion of the construction activities with durations ranging from less than a year to up to 2 years for larger projects and would be considered short-term noise. Very large projects covering vast areas and involving many individual construction projects have the potential to expose receptors for a much longer period and would be considered long-term noise. On Guam, there are no regulatory requirements requiring construction noise levels to remain below certain levels. In the absence of specific requirements, guidance provided from several sources warrants consideration. The USEPA generated permissive noise levels based upon L_{eq} for 8- and 24-hour periods. Since daily construction durations would be about 8 hours, the limit for 365 days per year exposure is 75 dBA when the ambient noise levels are 60 dBA or less. Otherwise, 70 dBA is used and the 24-hour standard is also 70 dBA. For short-term noise when the receptor is within range of the construction activities, the USEPA guidance can apply to the individual receptor. From an individual perspective on very large projects, noise impacts from construction activities on the opposite side of the overall project area would not affect that particular individual, but rather a different individual located nearest the construction activities.

Construction noise lasting many years may only affect individual receptors when activities are close to the receptors but create an overall noise environment enduring throughout the life of the project. Noise can be simulated to emanate from the center of the project area and can be considered long-term noise. For long-term construction activities, other considerations such as annoyance and land-use planning criteria could apply to construction noise. Research has indicated that about 87% of the population is not highly annoyed by outdoor sound levels below 65 dB DNL (Federal Interagency Committee on Urban Noise [FICUN] 1980). Construction noise uses L_{eq} during the hours of construction operations versus DNL that uses a 24-hour period.

Traffic Noise - Under GDPW policy, loudest hourly noise level L_{eq} (h) standards are established for traffic noise relative to land use activity categories, as summarized in Table 3.4.2-1.

Table 3.4.2-1. Guam Loudest Hourly Noise Standards for Transportation Noise and Land Use Activity

Activity Category	*Leq [h] dBA*	*Description of Activity Category*
A	57 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, places of worship, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	Undeveloped lands.
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: GDPW 2009.

Ground-Based Training Noise - The Marine Corps adheres to a guidance memo dated June 29, 2005 (Marine Corps 2005) for regulating ground training noise (e.g. LFTRC activities). Noise zones are used in land use planning around Marine Corps installations. Table 3.4.2-2 describes these zones and general land use compatibility within these zones. The regulatory framework for noise hazards governed by compatible land use or zoning requirements are further discussed in Section 3.6.2, Land and Submerged Land Use, under the regulatory framework sub-section. Federal consistency under the Coastal Zone Management Act requires, to the maximum extent practicable, compliance with local noise standards where applicable.

Table 3.4.2-2. Noise Zones and Compatibility Levels

Zone	*Small Arms/Aviation A-weighted DNL*	*Explosives Day Night Average C-weighted DNL*	*Compatibility with Residential/ Noise Sensitive Land Uses*
1	<65 dB ADNL	<62 dB CDNL	***Compatible*** **-** usually suitable for all types of land use activities (e.g., homes, schools, and hospitals). Land Use, Planning and Zoning Committee contours are a subset of a Zone 1 area with noise levels between 57 dB CDNL and 62 dB CDNL that are compatible, but noise complaints could increase on days of higher than normal range activities.
2	65 to 75 dB ADNL	62 to 70 dB CDNL	***Normally Incompatible*** **-** normally considered incompatible with noise-sensitive land uses and use of the land within the zone should normally be limited to activities such as industrial, manufacturing, transportation, and resource production (e.g., industrial parks, factories, and highways).
3	>75 dB ADNL	>70 dB CDNL	***Incompatible*** **-** incompatible with noise sensitive land uses such as churches, schools, parks, and playgrounds.

Sources: U.S. Army Center for Health Promotion and Preventive Medicine 2009; Army 2007.

3.4.3 Approach to Analysis

3.4.3.1 Methodology

Noise resulting from implementation of the proposed action is compared to existing noise levels to assess potential impacts. This section describes the types of noise that comprise the current noise environment that would occur during construction and operation phases of the proposed action. Short-term noise-generating activities associated with the proposed action assessed in this SEIS would be construction of cantonment/family housing and LFTRC training activities. Long-term operational noise would be primarily due to traffic around the cantonment/family housing area and the routes to and from the LFTRC, and the small arms noise generated by live-fire training.

Aircraft Noise - Although new types of aviation activities are not being proposed, AAFB-based aircraft operations dominate much of the existing noise environment in the northern part of Guam. Wherever applicable, this analysis uses the aircraft noise study presented in the 2010 Final EIS (Volume 9, Appendices, Appendix K: Additional Reports-Noise) for baseline conditions and comparison to proposed activities.

Traffic Noise - During the development of the 2010 Final EIS (Volume 6, Chapter 8: Noise, Section 8.2.6: Off-Base Roadways, pages 8-11 to 8-52), traffic noise for both baseline and full buildup were calculated. In areas away from AAFB and to a lesser extent from Guam International Airport (i.e., areas where aircraft noise is less prevalent), traffic noise would be the predominant noise source.

Construction Noise - The use of heavy equipment on job sites generates construction noise that is short-term in duration (i.e., the duration of the construction period). In general, construction island-wide may occur for a long period of time but at individual receptors. The impacts would only occur during construction activities, and would affect adjacent receptors. Table 3.4.3-1 provides a list of representative samples of construction equipment and associated noise levels, adjusted for the percentage of time equipment would typically be operated at full power at a construction site. More information about construction noise is discussed in the 2010 Final EIS (Volume 2, Chapter 6: Noise, Section 6.1.1, Definition of Resource, Construction Noise, pages 6.5 to 6.6).

For short-term noise impacts, a set of typical construction is estimated and assumed to occur as near as possible to a receptor and noise levels are calculated assuming a maximum adverse impact to that given receptor. The sound intensity along with the time and distance between the noise source and receptor determine the impacts upon the receptor. Unlike traffic, range, or airport noise where the location of noise sources remain consistent and noise levels emanate away from the source and presented as noise contours, long-term construction noise to determine annoyance and residential compatibility can be estimated two ways. First, similar to short-term noise, would be receptor dependent and expressed as the distance away from a receptor that noise levels are below the 65 dBA. The second method would be to simulate the noise source as all of the construction activity occurs at the center of the site and the noise is calculated relative to the center of the overall project area.

Table 3.4.3-1. Samples of Construction Noise Equipment

Equipment Description	*Impact Device[1]*	*Acoustical Usage Factor[2] (%)*	*Actual Measured Maximum Sound Level @ 50 feet[3] (dBA, slow) (Samples Averaged)*	*Number of Actual Data Samples[4] (Count)*
All Other Equipment > 5 HP	No	50	NA	0
Backhoe	No	40	78	372
Clam Shovel (dropping)	Yes	20	87	4
Compactor (ground)	No	20	83	57
Compressor (air)	No	40	78	18
Concrete Mixer Truck	No	40	79	40
Concrete Saw	No	20	90	55
Crane	No	16	81	405
Dozer	No	40	82	55
Dump Truck	No	40	76	31
Excavator	No	40	81	170
Front End Loader	No	40	79	96
Generator	No	50	81	19
Grader	No	40	NA	0
Impact Pile Driver	Yes	20	101	11
Jackhammer	Yes	20	89	133
Pavement Scarifier	No	20	90	2
Paver	No	50	77	9
Roller	No	20	80	16
Scraper	No	40	84	12
Tractor	No	40	NA	0
Vibratory Pile Driver	No	20	101	44

Legend: NA = not applicable.
Notes: [1]Indication whether or not the equipment is an impact device.
[2]The acoustical usage factor refers to the percentage of time the equipment is running at full power on the job site and is assumed at a typical construction site for modeling purposes.
[3]The measured "Actual" emission level at 50 feet for each piece of equipment based on hundreds of emission measurements performed on Central Artery/Tunnel, Boston MA work sites.
[4]The number of samples that were averaged together to compute the "Actual" emission level.
Source: U.S. Department of Transportation 2006.

Range Operations

For live-fire training at the five proposed small arms ranges, noise was calculated using the Small Arms Range Noise Assessment Model (SARNAM) (SARNAM, Version 2.6.2003-06-06). For the proposed HG Range at Andersen South, noise was calculated using the Blast Noise Impact Assessment (BNOISE2) modeling program (BNOISE2, Version 1.3.2003-07-03). The SARNAM and BNOISE2 models are standard noise modeling methodologies that are widely used for range operational noise analyses.

Gunshot sounds are impulsive in nature and occur over a very short period in time, only a few thousandths of a second. Unlike topographic contours, noise contours are not intended to be precise delineation of the noise zones. Meteorology, topography, density of intervening vegetation, the receiver's

perception of the source, etc., can influence the level or impact of noise. Noise contours do not clearly divide noise zones with one side of the line compatible and the other side incompatible. The SARNAM calculation algorithms assume weather conditions or wind direction that favors sound propagation. The SARNAM program cannot account for the terrain at Guam.

Inputs to the SARNAM model included the following parameters:

- The location and configuration of each range (including number of lanes, and distance between firing point and target).
- Approximate number of days the range is utilized annually.
- Weapons to be fired at each of the ranges.
- Percentage of night firing.
- Information on the range physical features (e.g., absorption material, backstop height, and distance parameters for barriers, and baffles).

Land and water data are entered into the model because there is greater sound reflection as sound propagates over water than when sound propagates over land. Once the aforementioned parameters are entered into the model, results are portrayed as CDNL contours providing a visual picture of where noise impacts would occur.

BNOISE2 model inputs for the HG Range included information on the location and configuration of the proposed HG Range, number of firing points, number of pits, and estimated use rates. Similar to SARNAM, BNOISE2 cannot account for terrain.

3.4.3.2 Impact Assessment Criteria

Noise impacts result from perceptible changes in the overall noise environment that increase annoyance or affect human health. Annoyance is a subjective impression of noise wherein people apply both physical and emotional variables. Human health effects such as hearing loss and noise-related awakenings can result from exposures to noise. For this SEIS, noise is evaluated for airfield operations, aviation training, ground-based training, construction, and traffic. Because the noise metrics vary between noise sources, the impact assessment criteria for each activity are provided. It is not anticipated that maintenance activities would noticeably contribute to the noise environment due to their intermittent nature and short duration. The threshold levels of significant impacts for noise are:

- *Construction:* Noise resulting from construction activities usually last only during daylight hours for approximately eight hours per day. The USEPA generated permissive noise levels based upon L_{eq} for 8- and 24-hour periods. Since daily construction durations are about 8 hours, the limit for 365 days per year exposure is 75 dBA. The 24-hour standard is 70 dBA.
- *Ground-based training:* Small arms and hand grenades used for live-fire exercises generate noise during ground-based training. In this case, the criteria threshold for a significant impact would be whether the increase in noise creates an incompatible land use in Zones 2 and 3.
- *Traffic:* Noise associated with traffic must comply with GDPW standards and varies depending upon the particular land use.

The impact assessment criteria expressed in this section applies to human receptors but noise could also affect biological resources, land use, and cultural resources. Please see the specific resource sections for details about noise impacts to these other resources.

3.4.3.3 Public Scoping Issues

The scoping comments/concerns regarding noise are summarized as follows:

- Opposition to the Route 15 alternatives because of potential noise impact to nearby residents.
- General noise concerns, including traffic and helicopter noise.
- Requests for identification of current noise impacts and the number of individuals that would be affected by noise.
- Request for the development of mitigation measures, as well as analysis of the amount of noise reduction that would be expected from mitigation measures and identification of the number of individuals that would still be significantly affected after mitigation.
- Concerns about existing noise from training activities at Andersen South.
- Impacts to human health from noise.
- Impacts to wildlife from noise.

3.5 AIRSPACE

3.5.1 Definition

In the United States, airspace is a resource that is managed by the FAA with established policies, designations, and flight rules. These measures are in place to protect aircraft on the airfield, en route, in SUA identified for military and other governmental aviation activities, in other military training airspace, and for ground training activities that require the use of airspace over ground firing areas or other hazardous activities on the ground that impact the airspace overlying the activity. The FAA Western Service Area (Renton, Washington) provides guidance and control of U.S. territory airspace in the Pacific that includes Guam and CNMI. Guam Air Route Traffic Control Center (ARTCC), Guam Approach Control, and Guam Departure Control manage air traffic in Guam. AAFB is responsible for providing ATC service in the Class D airspace surrounding AAFB airfield, control of air operations at NWF, and Terminal Instrument Procedure design for Instrument Flight Rules (IFR) arrivals and departures servicing AAFB.

National airspace is divided into two broad categories: *controlled* and *uncontrolled* airspace. Contained in the 2010 Final EIS is a detailed description of airspace classifications and features of each class of airspace.

Established by the FAA, SUA is designed to alert users about areas of military activity, unusual flight hazards, or national security needs, and to segregate that activity from other airspace users to enhance safety. The type of SUA that pertain to the proposed relocation of Marines to Guam outlined in Chapter 2 of this SEIS is a Restricted Area, which would be required for LFTRC operations. Other airspace designations for special military use relevant to Guam include: military training routes, Air Traffic Control Assigned Airspace (ATCAA), slow routes, low altitude tactical navigation areas, and local flying areas. Resource description and definition for airspace on Guam is contained in the 2010 Final EIS (Volume 2, Chapter 7: Airspace, Section 7.1: Affected Environment, pages 7-1 to 7-7).

3.5.2 Regulatory Framework

Airspace management procedures assist in preventing potential conflicts or accidents associated with aircraft using designated airspace in the U.S., including Restricted Area SUA established for military activities. As described in Title 49, USC § 40101 of 49 USC, airspace management involves the coordination, integration, and regulation of the use of airspace. The FAA has overall responsibility for

managing airspace through a system of flight rules and regulations, airspace management actions, and ATC procedures. All military and civilian aircraft are subject to Federal Aviation Regulations. The FAA's *Aeronautical Informational Manual* defines the operational requirements for each of the various types or classes of military and civilian airspace.

FAA Joint Order 7400.2J, *Procedures for Handling Airspace Matters* (FAA 2012), provides a listing of existing airspace area designations and descriptions and establishes the regulatory framework for obtaining SUA. In addition, FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures* (FAA 2006), establishes requirements that proponents of SUA proposals must meet prior to the FAA's final decisions on granting Restricted Area SUA. These requirements, together with MCO, DON Instructions, and DoD Directives and Guidance, establish the regulatory framework considered in this SEIS.

3.5.3 Approach to Analysis

3.5.3.1 Methodology

Impacts on airspace use are assessed by evaluating the potential effects of proposed training activities on the principal attributes of airspace use. Following is a discussion of the impact categories and how they were assessed for this proposed action:

- Impacts on controlled and uncontrolled airspace were assessed by determining if the proposed action would reduce the amount of navigable airspace by creating new or expanding existing SUA, or by introducing temporary flight restrictions or presenting an obstruction to air navigation.
- Impacts on SUA were assessed by determining the proposed action's requirement for new SUA.
- Impacts on en route airways were assessed by determining if the proposed action would lead to a change in a regular flight course or altitude or instrument procedures.
- Impacts on airports and airfields were assessed by determining if the proposed action would restrict access to or affect the use of airports/airfields available for public use or if it would affect airfield/airport arrival and departure traffic flows.

Factors used to assess impacts on air traffic include consideration of an alternative's potential to result in an increase in the number of flights such that they could not be accommodated within established operational procedures and flight patterns; a requirement for airspace modification; or an increase in air traffic that might increase collision potential between military and non-participating civilian operations.

FAA Western Service Area, Guam ARTCC, Marine Forces Pacific, NAVFIG, and OPNAV N98 conducted preliminary airspace feasibility studies for all LFTRC alternatives from January to March 2013. These studies identified potential issues to aviation within the following:

- Guam International Airport instrument approach procedures.
- AAFB instrument approach procedures.
- Standard Instrument Departures and Standard Terminal Arrivals.
- Military Training Routes.
- IFR/Visual Flight Rules (VFR) traffic flows and terminal operations.
- Known but uncharted high volume routes.
- Guam International Airport airspace.
- AAFB airspace.
- Existing SUA/Terminal Radar Service Area.
- VFR Reporting Points.

3.5.3.2 Impact Assessment Criteria

Based in part on FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures* (FAA 2006) and FAA Joint Order 7400.2J, *Procedures for Handling Airspace Matters* (FAA 2012), an action is considered to have a potential significant airspace impact if it would result in any of the following:

- Reduce the amount of navigable airspace resulting in adverse aeronautical impacts to non-participating users that could not be mitigated.
- Create an obstruction to air navigation.
- Assign new SUA (including Controlled Firing Areas, RAs, Warning Areas [WA], and Military Operations Areas) or require the modification of existing SUA that would have adverse aeronautical impacts that could not be mitigated.
- Change an existing or planned IFR minimum flight altitude, a published or special instrument procedure, or an IFR departure procedure or require a VFR operation to change from a regular flight course or altitude.
- Reduce public health and safety due to a change in aviation safety risk.
- Restrict access to or effects on the use of airports and airfields available for public use.
- Change commercial or private airfield or airport arrival and departure traffic flows.

3.5.3.3 Public Scoping Issues

No airspace issues were raised during scoping.

3.6 LAND AND SUBMERGED LAND USE

3.6.1 Definition

There are two components relative to the discussion of land and submerged land: ownership and use. Submerged lands refer to ocean areas between the coast and 3 nautical miles (5.6 km) from the coast.

3.6.1.1 Land and Submerged Land Ownership

Land ownership in this SEIS is generally described as federal, GovGuam or private. As applicable, federal lands are further characterized by the agency that has custody and control over the land, such as DoD or DOI. The land use assessment considers existing land use and planned land uses, both on-base and off-base. Background information on the history and current land tenure and management on Guam is provided in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.1, Affected Environment, pages 8-1 to 8-8). Land and submerged land ownership is shown in Figure 3.6.1-1. Federal submerged lands are adjacent to current and former federal property (Figure 3.6.1-1).

Table 3.6.1-1 lists the land ownership acreages presented in the 2010 Final EIS and the updates of 2013. The 2013 ownership information was provided by the Guam Bureau of Statistics and Plans (GBSP) for the Socioeconomic Impact Assessment Study (SIAS) update (Appendix D, Section 5.1.2). The Guam Department of Land Management has primary responsibility for compiling land ownership data. Additional land ownership discussion is provided in the Socioeconomics and General Resources sections of this SEIS.

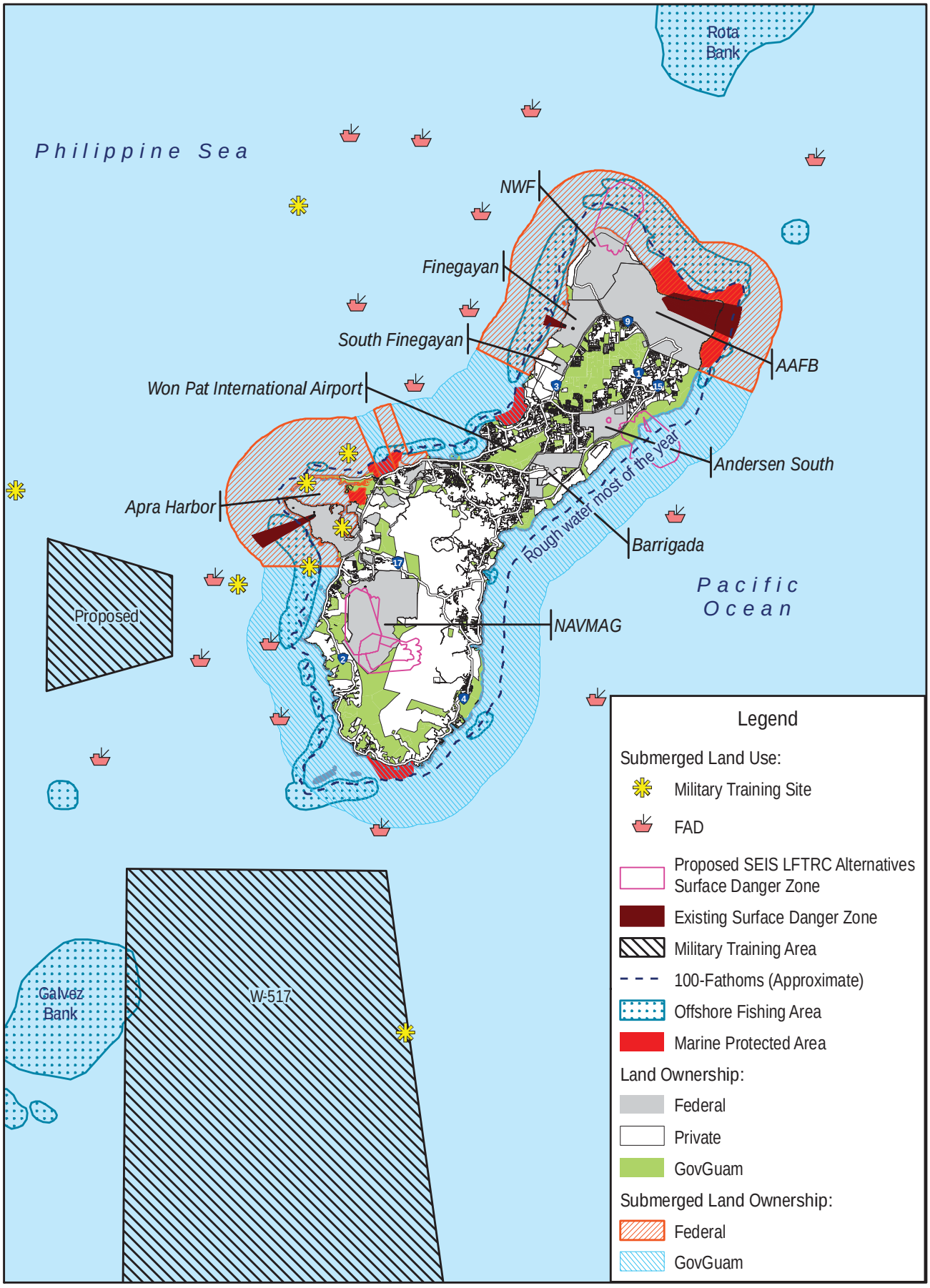


Figure 3.6.1-1
Guam Land/Submerged Land Ownership

Source: NAVFAC Pacific 2013

Both sets of data in Table 3.6.1-1 are estimates based on geographic information system (GIS) analysis and do not represent surveyed land boundaries. GBSP confirmed there was a release of GovGuam land to private landowners subsequent to the 2010 Final EIS that explains the reduction in GovGuam land from 48% to 19% of the total land area. The DON's 2013 GIS data for federal lands and the total area are estimated as 35,576 acres (14,397 ha), which is less than the 2010 DON and the 2013 GBSP estimate of 35,939 acres (14,544 ha) in Table 3.6.1-1. The parcel west of South Finegayan, referred to as the Guam Land Use Plan 77 parcel in the 2010 Final EIS, was released by the federal government subsequent to the ROD, thereby reducing federal land ownership by approximately 450 acres (182 ha). Additional land that was released includes segments on Route 1 and Route 4.

Table 3.6.1-1. Guam Land Ownership

Owner	*2010 Final EIS*		*GBSP 2013*	
	Area (acres/ha)	*Percent*	*Area (acres/ha)*	*Percent*
Federal	37,088 (15,009)	27	35,939 (14,544)	27
GovGuam	63,988 (25,895)	48	25,581 (10,352)	19
Private	33,238 (13,451)	25	72,957 (28,525)	54
Totals	**134,314 (54,355)**	**100**	**134,477 (54,421)**	**100**

Note: There are discrepancies in the total Guam land area totals that are attributed to mapping errors.

The DON is required to comply with federal land acquisition law and regulations that include the requirement to offer just compensation to the owner, to provide relocation assistance services and benefits to eligible displaced persons, to treat all owners in a fair and consistent manner, and to attempt first, in all instances, acquisition through negotiated purchase. A more detailed discussion of the federal land acquisition process is described in the SIAS, Appendix D of this SEIS.

3.6.1.2 Submerged Land Use

Figure 3.6.1-1 shows key submerged land uses and constraints. The Surface Danger Zones (SDZ) associated with existing firing ranges extend into submerged lands. When a range is in use, public access to the SDZ is restricted. In addition to the land-based training areas that generate SDZs into submerged lands, there are existing and proposed military training areas (e.g., warning areas [W-517]), and smaller training sites within submerged lands (e.g., mine detonation sites, parachute drop zones) that also restrict public access during training events (see Figure 3.6.1-1). W-517, located south of Guam, represents the largest area of submerged land restriction. The current training tempo in W-517 is four events per year and this would increase to five when the Mariana Islands Testing and Training EIS/OEIS Record of Decision is published. A new training area is proposed in the EIS/OEIS west of Guam (NAVFAC Pacific 2013a). A notice to mariners is issued for all training events and a red flag is raised near the onshore ranges to inform the public of the restricted access.

Fishing in the offshore areas around Guam is for recreational and subsistence purposes and not for commercial purposes. The following information about Guam fishing was provided by the Guam Fishermen's Cooperative Association (GFCA) in their comment letter on the Draft SEIS (see Appendix G, comment 677). According to the GFCA, the catch is primarily for family and community use, as fish that are not consumed by fisherman and their families are bartered, used as gifts, or sold to pay for expenses incurred for fishing trips. Generally, fishing trips are limited to one day. There is a nearshore fishery and offshore fishery. Boat access is limited to the lower half of Guam and primarily the west coast, including Gregorio D. Perez Marina in Hagåtña, Agat Marina, Merizo Pier on the southern coast, and Sumay Cove Marina at Apra Harbor. There also is a boat ramp at Inarajan on the east coast. The

limited boat access, minimal shore access due to coastal clifflines, and the rough ocean conditions on the east coast during most of the year severely limit fishing opportunities off of the eastern coast of Guam.

Offshore fishing areas that are only accessible by boat are shown on Figure 3.6.1-1. Fishing areas tend to be aligned along the 100-fathom contour, which equates to approximately 600 feet (183 m) in ocean depth (Squire and Smith 1977). In addition to the natural fishing areas, manmade Fish Aggregating Devices (FAD) are frequented by fishing boats (see Figure 3.6.1-1 for FAD locations).

Nearshore coral reefs are popular fishing areas. There are shallow water moorings off the west and south coasts of Guam, but none are located north or east of Guam. The GovGuam Division of Aquatic and Wildlife Resources (GDAWR) designated five nearshore Marine Protected Areas (MPA) (see Figure 3.6.1-1) for the protection and preservation of aquatic life, habitat, and marine communities and ecosystems. Fishing within these areas is subject to restrictions.

As stated in the GFCA Draft SEIS comments (Appendix G, comment 677), most fishermen stay within 6 to 10 miles (10 to 16 km) of the coast, and between approximately 12 miles (19 km) north of Hagåtña Marina and the same distance south from Agat Marina.

However, the GFCA also noted that there are some fishermen that will venture further north or south to the distant seamounts, weather permitting. The most favorable months for fishing are May through September, due to weather conditions.

3.6.1.3 Land Use

Background information on land use planning and available resources was provided in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.1.1.5: Land Use, pages 8-8 to 8-17). This SEIS analysis was based on the following resources:

- Existing land use beyond military installation boundaries was derived from assessments of aerial photographs, which served as the foundation for the figures presented in the analysis.
- Lot boundary, ownership, acreage and other GIS data on the lands proposed for acquisition were from NAVFAC Pacific data files.
- Planned land use was based on best available information for the geographic area. The primary references were land use plans if available because they represent community planning goals. Zoning laws to implement community land use plans often lag behind land use planning documents.

The GBSP GIS of land use classification for land planning purposes was used if community land use plans were not available for a geographic area. The GBSP provided an update of the GIS files for land use classification (Figure 3.6.1-2). The land use classification nomenclature differs from the zoning code and the land use plans.

Existing land use plans and related information include the *North and Central Guam Land Use Plan* (GBSP 2009) and the Zoning Map for the Dos Amantes Planning Area (Guam Land Use Commission 2008). The land use plans did not share the same nomenclature but established a land use pattern to guide future development as shown in Figure 3.6.1-3. No land use plans were identified for the southern portion of the island.

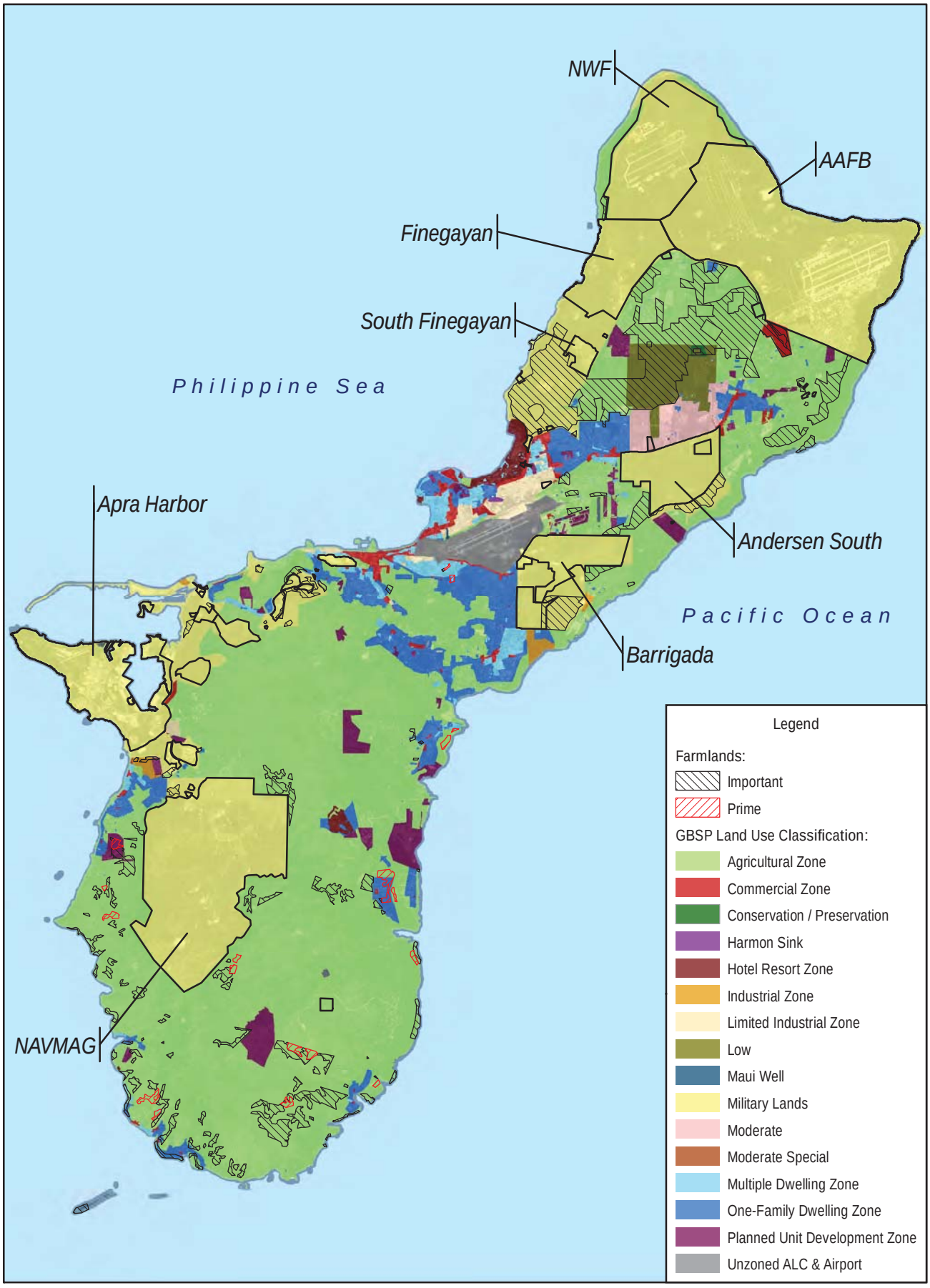
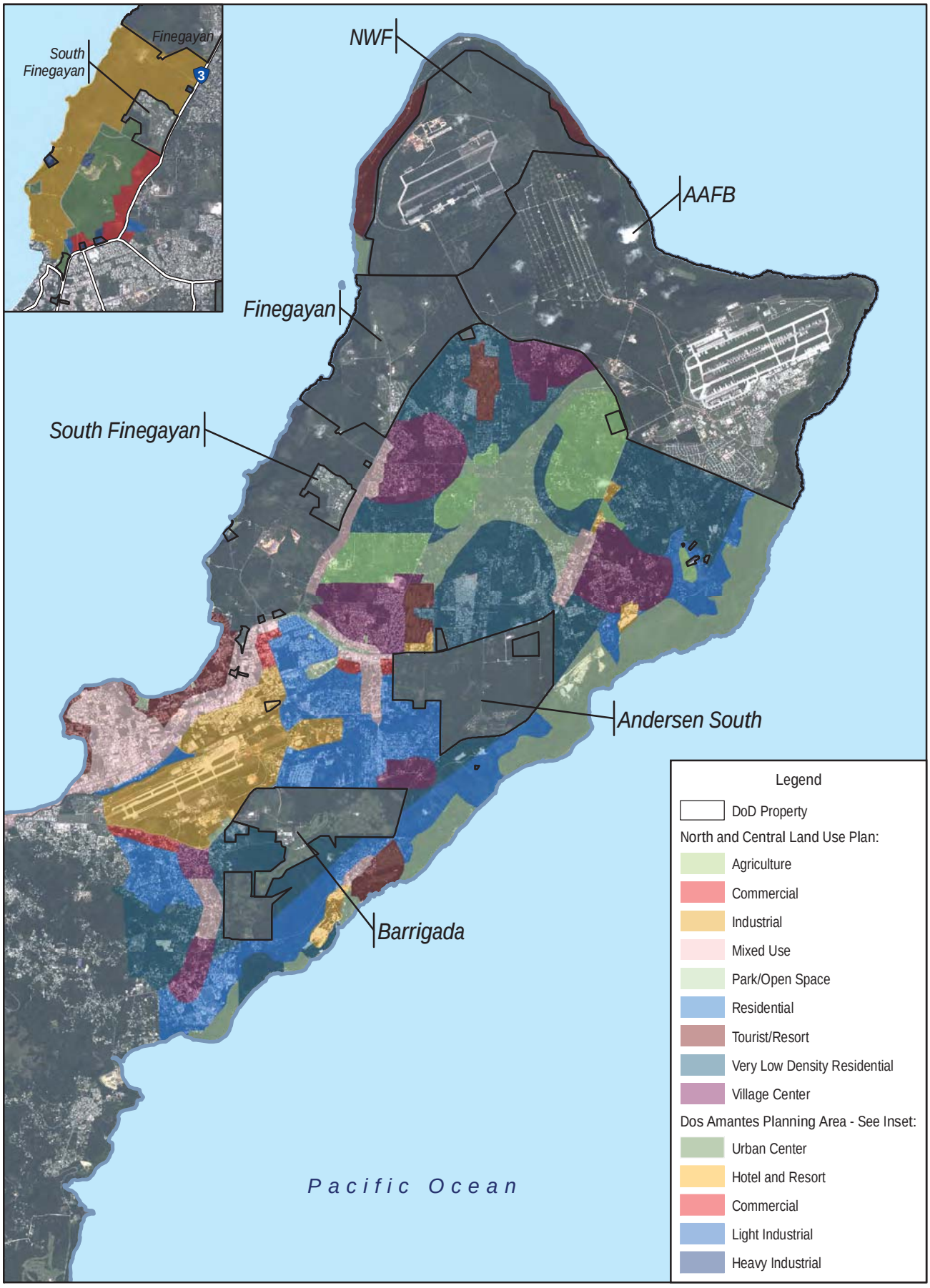


Figure 3.6.1-2
Guam Land Use

Sources: GBSP 2013; NAVFAC Pacific 2013



0 2 4 Miles

0 2 4 Kilometers

Figure 3.6.1-3
North and Central Land Use Plans

N

Sources: NAVFAC Pacific 2010, 2013

Various sections of the zoning code were developed over time, and the most recent zoning maps were "adopted" in 1967. Subsequent changes to the zoning have been incremental through individual zone change requests or legislative initiatives. The zoning map is not current and is not based on long range development policies on Guam. Therefore, the GBSP land classification graphics and land use plans were determined to be a more accurate assessment of land use goals in the community that would guide future development.

The importance of agricultural lands is described in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.1.1.5: Land Use, Farmlands, pages 8-13 to 8-14). Preserving agricultural lands and promoting sustainable food production are recurrent themes in local policies. There are many challenges to meeting these goals, one of which is competing land uses. The land use discussions in this SEIS identify potential impacts to agricultural land uses. The USDA, in cooperation with GovGuam, designated prime and important farmlands on Guam. Important farmlands are lands that do not meet USDA criteria for unique or prime farmland but are considered to be farmland of statewide importance, based on local government criteria. The USDA farmland data have not been updated since the 2010 Final EIS and are shown on the land use graphics in this SEIS. Federal lands are not assigned a farmland designation.

3.6.2 Regulatory Framework

There are federal regulations guiding federal land acquisition, but they do not address land use impacts. Military installation master plans guide land use planning on-base, but do not dictate land use. The Coastal Zone Management Act (CZMA) provides states and territories, with federally approved coastal management programs, the authority to review federal activities that have a reasonably foreseeable effect on any land use, water use, or natural resource of the coastal zone. Federal agencies provide a consistency determination for proposed federal agency activities. Federal activities are reviewed for consistency with enforceable policies of state or territorial management programs and states or territories either concur with or object to the activity. If a state or territory objects to a federal agency activity, the federal agency may not proceed unless it determines it is prohibited from full consistency due to requirements of federal law.

The CZMA coordination between GBSP and Joint Region Marianas (JRM) has been completed. The CZMA requires that federal activities that affect the coastal zone be undertaken consistent with the Guam Coastal Management Program's enforceable coastal policies (which include land use and environmental policies). The DON has integrated the CZMA and NEPA processes by incorporating where necessary the accepted Guam Coastal Management Program's conditions into the Final SEIS as BMPs in Table 2.8-1, if not already addressed elsewhere as a BMP or as a mitigation measure. Agency correspondence between the Navy and GBSP for the Programmatic Coastal Consistency Determination for the Marine Corps Relocation is provided in Appendix C. In accordance with provisions for phased determinations in 15 CFR Part 930.36, the Navy will continue to submit future project-specific determinations to GBSP for federal consistency review as design-level information becomes available.

The Territorial Submerged Lands Act (48 USC §§ 1705 *et seq.*) provided for the conveyance of submerged lands extending 3 miles (4.8 km) seaward from the line of mean high tide owned by the U.S. to Guam. Nothing in the Act affects the status of submerged lands beyond the 3-mile (4.8-km) limit. The Act excepted certain submerged lands from conveyance to Guam, including all submerged lands owned by the U.S. adjacent to property owned by the U.S. above the line of mean high tide. The Act also reserves various rights of the U.S. that remain unaffected by the congressional conveyance of these submerged lands. Specifically, the President retains the right to establish naval defensive sea areas and

naval airspace reservations around and over the island of Guam when deemed necessary for national defense, and the U.S. retains all of its navigational servitude and rights in and powers of regulation and control of these conveyed submerged lands and the overlying navigable waters for the constitutional purposes of commerce, navigation, national defense, and international affairs.

The National Wildlife Refuge System Administration Act (16 USC §§ 668dd-668ee) establishes a unifying mission for the NWR System, a process for determining compatible uses of refuges, and a requirement for preparing comprehensive conservation plans. The Act states that the mission of the Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. The Act authorizes the Secretary of Interior, under such regulations as he/she may prescribe, to "permit the use of any area within the System for any purpose, including but not limited to hunting, fishing, public recreation and accommodations, and access whenever he/she determines that such uses are compatible with the major purposes for which such areas were established." The Guam NWR is part of the System, and any new uses of the Refuge associated with the proposed action must be compatible with the mission of the System and the purposes of the Refuge. Section 3.8.1.2 in this SEIS identifies the purposes for which the Guam NWR was established, and Section 5.5.8.2 describes the potential impacts to the Guam NWR.

MPAs are described under Section 3.9.1.4 and the potential impacts are described in Marine Biological Resources impact sections of this SEIS.

The GovGuam regulates land uses through a system of zone and subdivision variances (permitting) that may require formal public participation (and notice), and environmental/economic assessment considerations by the Guam Land Use Commission and Guam Seashore Protection Commission. The commissions consider land use trends (usually their past decisions) in an effort to be consistent and minimize harm to adjacent or nearby landowners.

Community master plans and associated zoning codes are adopted to guide development to meet community long-term planning goals. There is typically a lag time in adopting new codes subsequent to approval of a master plan. Therefore, the master plan initiatives may not be immediately enforceable. Federal land uses are not subject to local zoning laws.

Military land use constraints are established in the interest of public health and safety, including explosive safety quantity-distance (ESQD) arcs, noise contours, or Air Installation Compatible Use Zone (AICUZ) noise and safety guidelines. Military land use also considers conservation aspects such as the Guam NWR. The land use impact analysis in this SEIS identifies existing and potential land use incompatibilities but refers the reader to other SEIS resource sections that specifically address the significance of the impact from a regulatory perspective. The land use analysis focuses primarily on whether the proposed action would impact existing or future land uses off-base.

3.6.3 Approach to Analysis

3.6.3.1 Methodology

The approach to analysis for land and submerged land use was described in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.2: Environmental Consequences, pages 8-56 to 8-58). The 2010 Final EIS described two components to the analysis: (1) land/submerged land ownership, and (2) land/submerged land use. Similar to the 2010 Final EIS approach, all land and submerged land use impacts are considered long-term impacts and are described under the operation phase. Construction-

phase impacts are described as "no impact" throughout this SEIS. This SEIS assessment differs from the 2010 Final EIS in the following respects:

- Land ownership impacts are addressed in the Socioeconomics and General Services sections.
- The land use impact assessment criteria have been modified (see Section 3.6.3.2 of this SEIS).

Best available data on existing land uses and community plans were used to describe the affected environment and were compared to the action alternative's land use data. The analysis was based on best available published data and did not include field verification or government records review.

3.6.3.2 Impact Assessment Criteria

The following impact assessment criteria for land and submerged land use impacts are evaluated in this SEIS:

- Incompatibility with current or planned land/submerged land use - incompatibility could result when off-base land uses would be constrained by the proposed action.
- New restrictions on public access to land and submerged land - restricting public (non-federal) access or increasing the restrictions on existing access to land or submerged land could result in adverse impacts if access to a community-valued land use would be affected.
- Change in an existing land use that is valued by the community - when the proposed action reduces or eliminates an existing land use that is unique or important to the community, there could be a significant land use impact.

It is important to note that land use changes affect other resource areas, including but not limited to recreational resources, terrestrial biological resources, noise, and socioeconomics and general services. These impacts are considered indirect impacts under the land and submerged land use analysis but direct impacts under other affected resources. The land and submerged land use environmental consequences section refers readers to the relevant resource sections of this SEIS for the impact analysis when a potential land use incompatibility is identified.

3.6.3.3 Public Scoping Issues

The scoping comments/concerns regarding land and submerged land use are summarized as follows:

- The International Raceway Park is an important land use that should be retained.
- New access roads in the NAVMAG area could induce public access to these areas with potential adverse impacts, such as vandalism, illegal dumping and increased wildfires.
- Public access should be retained for Marbo Cave, Mount Lamlam, and Mount Jumullong.
- Firing ranges should be located away from populated areas.
- Avoid imposing new access restrictions to DoD or GovGuam submerged lands.

In addition, USFWS recommended eliminating the LFTRC alternative at NWF for a number of reasons, including that the alternative would compromise the ability of USFWS to carry out critical conservation and education actions.

3.7 RECREATIONAL RESOURCES

3.7.1 Definition

The definition of recreational resources in this SEIS remains unchanged from the definition described in the 2010 Final EIS (Volume 2, Chapter 9: Recreational Resources, Section 9.1.1: Definition of Resource, page 9-1). Recreational uses may include any type of outdoor activity in which area residents, visitors, or tourists participate. Typically (though not exclusively) focused on weekends, holidays, or vacation periods, such activities may include hiking, fishing, beachcombing, spelunking, boating, and organized team sports. There are various man-made recreational resources in urban and semi-rural settings around the island of Guam. These include parks, monuments, historical and cultural points of interest, and sports fields.

3.7.2 Regulatory Framework

Many of Guam's recreational resources are managed by the Guam Department of Parks and Recreation (GDPR), which administers approximately 70 public parks and recreational facilities, including beach parks, community parks, skate parks, historic parks, baseball fields, a baseball stadium, a sports complex, tennis courts, and two public pools. All other community centers and parks are managed by the 19 village mayors on the island who work closely with the GDPR. The GDPR also runs sports leagues and provides opportunities for swimming and tennis lessons, among other activities.

In addition to local requirements, marine recreational activities on federal submerged lands are governed by policies identified in the Guam Submerged Lands Management Plan, which references command instructions, policies, and applicable local regulations. Furthermore, the Guam Coastal Management Program enforceable policy for recreational resources states that the "Government of Guam shall encourage development of varied types of recreational facilities located and maintained so as to be compatible with the surrounding environment and land uses, adequately serve community centers and urban areas and protect beaches and such passive recreational areas as wildlife, marine conservation and marine protected areas, scenic overlooks, parks, and historical sites. Developments, activities and uses shall also comply with the Guam Recreational Water Use Management Plan."

To the maximum extent practicable, all proposed land uses will be consistent with the Guam Coastal Management Program recreation policy through DON coordination with GovGuam via the Coastal Zone Management Act. The DON recognizes that a number of recreational sites within DoD installations serve as a resource to the public, but consistent with local policy, decisions that may increase recreational activities must be weighed against the need to protect natural and cultural resources.

3.7.3 Approach to Analysis

3.7.3.1 Methodology

Information on recreational resources and public access on Guam was collected through various sources of data including the following:

- Guam Comprehensive Outdoor Recreation Plan Update (SCORP 2006).
- Final Guam Coastal Management Plan - Section 309 Assessment and Strategy (GCMP 2011).
- GIS.
- Literature review.
- Personal communications.

Information from other sources defined the scope of the project review and informed the framework of analysis. These sources included:

- 2010 Final EIS (including potential mitigation measures).
- 2010 Final EIS ROD.
- March 2012 public scoping report and comments.
- November 2012 public scoping and comments.

Consistent with the definition and criteria for an SEIS, this recreational resource analysis focuses its review on project areas and project description features that have changed since the ROD was signed for the 2010 Final EIS. This environmental review also identifies any changes that have occurred to recreational resources on Guam in the intervening years, and discusses the consequences of implementing the SEIS proposed action on those changed resources.

3.7.3.2 Impact Assessment Criteria

To preserve consistency with the 2010 Final EIS, the same determinations of significance were used in this SEIS. The proposed action and alternatives would cause a significant impact on recreational resources if they:

- Would impede access to recreational resources.
- Would substantially reduce recreational opportunities.
- Would cause substantial conflicts between recreational users.
- Would cause substantial physical deterioration of recreational resources.

For this SEIS, an overarching factor applied to all the alternatives analyses was the proposed reduction in the number of Marines and dependents coming to Guam compared to the numbers described in the 2010 Final EIS (see Chapter 1 of this SEIS). There is typically a direct relationship between impacts on recreational resources and increase or decrease in population.

Similar to the proposed alternatives described in the 2010 Final EIS, recreational facilities would be constructed as part of the proposed action to meet the needs of on-base personnel and dependents. These recreational facilities, while not necessarily open to the public, would assist in minimizing island-wide impacts to recreational resources by providing additional recreational options in the aggregate for both residents of, and visitors to, Guam.

Where applicable, indirect and secondary impacts (such as increased demand for substitute recreational resources due to new SDZs and the introduction of LFTRC noise to currently serene recreational spots) were filtered through the impact assessment criteria above.

3.7.3.3 Public Scoping Issues

The scoping comments/concerns regarding recreational resources are summarized as follows:

- Concerns regarding the loss of Guam International Raceway if Route 15 is chosen as the LFTRC preferred alternative.
- Potential impacts to Ritidian Point if NWF is selected as the LFTRC preferred alternative.
- General concerns about public access to the shoreline and access limitations to offshore fishing, diving, and boating areas.

3.8 TERRESTRIAL BIOLOGICAL RESOURCES

3.8.1 Definition

The terrestrial biological resources analysis focuses on species and vegetation communities that are important to the function of biological systems, of special public importance, or are protected under federal or local law or statute. For the purposes of this document, terrestrial biological resources are divided into four categories: vegetation communities, terrestrial conservation areas, wildlife, and special-status species. Species mentioned in this section are described using the common name when there is an accepted English common name. Scientific and Chamorro names can be found in Appendix F, Biological Resources.

3.8.1.1 Vegetation Communities

The vegetation communities that are assessed in this SEIS were described in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.1.1: Vegetation Communities, pages 10-1 to 10-6). However, for the purposes of this SEIS there have been some minor changes in the naming of vegetation categories. Two separate naming systems have been previously used to describe the vegetation of the areas on Guam addressed in this SEIS. The vegetation categories of AAFB are based on a relatively recent, detailed installation-wide vegetation mapping study (AAFB 2008). Vegetation categories for DON installations and private lands are from a variety of sources, primarily U.S. Forest Service (USFS) (2006), which are listed in Chapters 4 and 5 on each figure depicting vegetation communities. Table 3.8.1-1 provides a summary of the vegetation categories previously used for describing the vegetation communities on Guam and the corresponding category used in this SEIS. The most important vegetation communities on Guam serving as habitat for native wildlife species, including special-status species, are primary limestone forest ('primary' indicating the vegetation was probably never cleared and is dominated by native species), secondary limestone forest, ravine forest in southern Guam, and wetlands. Primary limestone forests in particular are important since they retain the functional components of native forest (e.g., large native trees, high canopy closure, that provide habitat for native species, particularly special-status species). Limestone forest communities are more vulnerable to disturbance and loss because they recover much more slowly due to the relative dry habitat and shallow soils which when damaged are sometimes irreversible (Clements *et al.* 2006; Tang *et al.* 2011).

Table 3.8.1-1. Vegetation Categories used in this SEIS

AAFB Categories[1]	*DON Installations and Private Lands Categories*[2]	*SEIS Categories*
• *Eugenia* Forest • *Neisosperma* Forest • Mixed Limestone Forest-Plateau/Primary • Mixed Limestone Forest-Toe Slope/ Primary • Mixed Limestone Forest-Foreslope	• Primary Limestone Forest • Limestone Forest (assumed primary when not categorized as secondary or disturbed) • Halophytic/Xerophytic Scrub	Primary Limestone Forest
• Disturbed Limestone Forest • Mixed Limestone Forest-Plateau/ Secondary • *Vitex*-Closed Canopy • *Vitex*-Open Canopy	Secondary Limestone Forest (includes the limestone forest, disturbed category)	Secondary Limestone Forest
(none comparable)	Ravine Forest	Ravine Forest
(none comparable)	Tangantangan (*Leucaena*)	Tangantangan
Coconut Plantation	Coconut Plantation	Coconut Plantation
Casuarina Forest	*Casuarina* Forest	*Casuarina* Forest
(none comparable)	Forested Wetland	Forested Wetland
(none comparable)	Herbaceous Wetland	Herbaceous Wetland
• Mixed Herbaceous Scrub • *Ochrosia* Edge • *Hibiscus-Leucaena* • *Hibiscus* Scrub	• Mixed Herbaceous Scrub • Scrub Forest • Other Shrub/Grass	Herbaceous Scrub
(none comparable)	Savanna	Savanna
(none comparable)	Agriculture	Agriculture
• Backstrand/Rock • Forestrand/Sand • Strand/Rock	Strand	Strand
(none comparable)	Barren	Barren
Developed Land	Developed	Developed

Sources: [1]AAFB 2008; [2]USFS 2006.

3.8.1.2 Terrestrial Conservation Areas

Terrestrial conservation areas are areas formally designated and managed by the DoD or other government agencies for the purpose of conservation or restoration of natural resources. These resources typically include threatened, endangered, or rare species or biotic communities, or areas of particularly valuable or unique habitat for such species or communities. As depicted on Figure 3.8.1-1 and summarized in Table 3.8.1-2, terrestrial conservation areas include:

- Conservation areas set aside by GovGuam.
- Ecological Reserve Areas (ERAs) and Natural Areas designated by the DoD.
- Mitigation areas resulting from consultation with USFWS under section 7 of the federal ESA.
- Guam NWR.
- NWR Overlay (Overlay Refuge) lands.

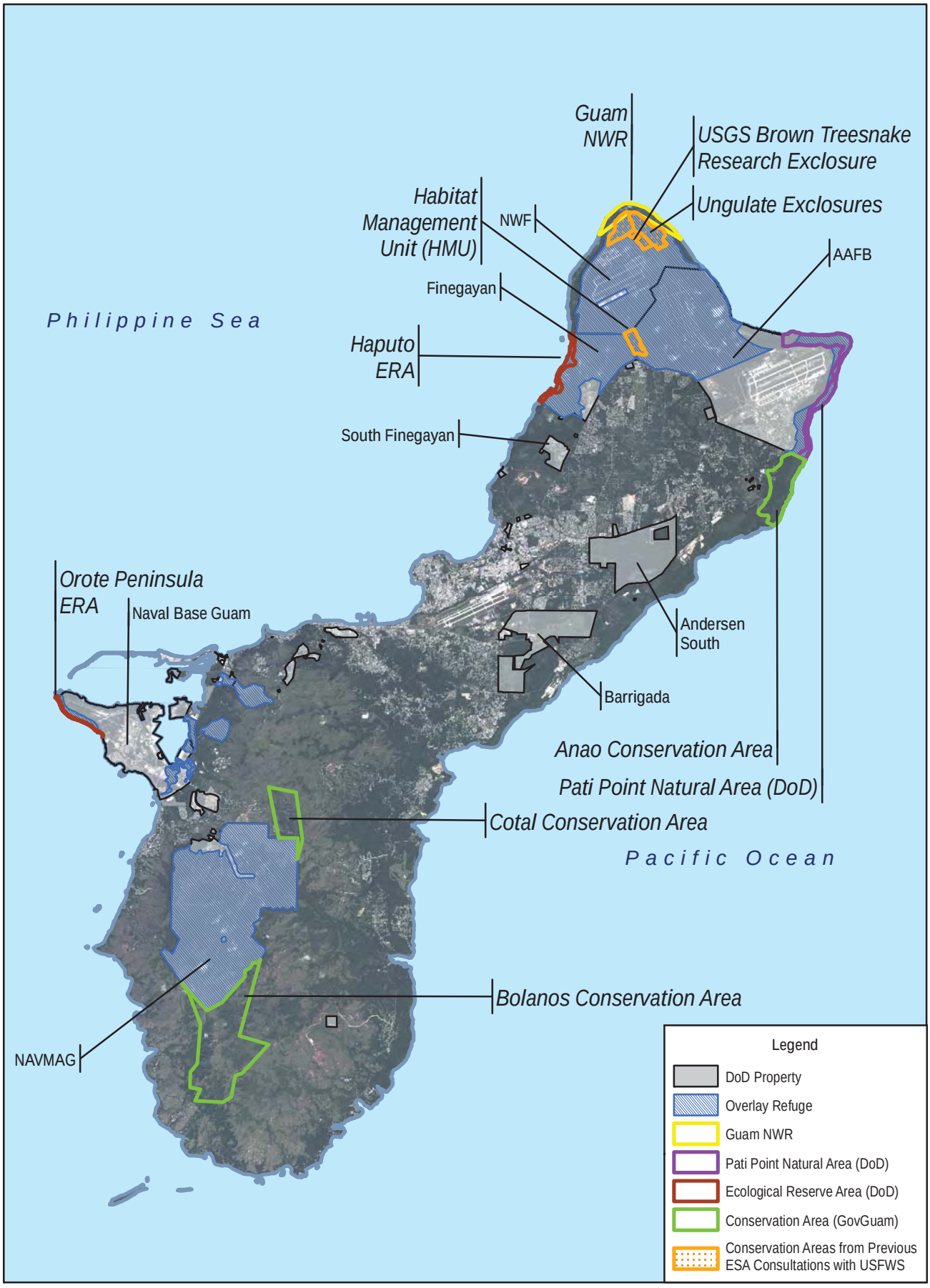


Figure 3.8.1-1
Guam Terrestrial Conservation Areas

Sources: GDAWR 2006; USFWS 2006a, 2006b; NAVFAC Pacific 2013

Table 3.8.1-2. Guam Terrestrial Conservation Areas

Name	*Area (acres [ha])*	*Management Plan*	*General Description*
GovGuam[(1)]			
Bolanos Conservation Area	2,854 (1,155)	No	Established by GovGuam in 1999 for conservation of habitat for the potential restoration of Species of Greatest Conservation Need as identified in Guam's Comprehensive Wildlife Conservation Strategy.
Anao Conservation Area	764 (309)		
Cotal Conservation Area	662 (244)		
Federal - DOI			
Guam NWR – Ritidian Unit*	370.6 (150.0) (terrestrial portion)	Yes[(2)]	Established in 1993 in response to the 1984 listing of six species as endangered under the ESA. The Refuge purposes are to: • conserve ESA-listed species; • develop, advance, manage, conserve, and protect fish and wildlife resources; • use the area as an inviolate sanctuary, or for any other management purpose, for migratory birds; and • provide for incidental fish and wildlife-oriented recreational development, the protection of natural resources, and the conservation of endangered or threatened species.
Federal - DoD			
Overlay Refuge	21,690 (8,778)	Yes[(3)]	Established in 1994 by Cooperative Agreements between the Navy, Air Force, and USFWS for a coordinated program centered on the protection of endangered and threatened species and other native flora and fauna, maintenance of native ecosystems, and the conservation of native biological diversity. The primary purpose of the lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force. See text for further details.
Haputo ERA	180 (73)	Yes[(4)]	Established to protect two biological units: • 180-acre (73-ha) terrestrial unit encompassing a remnant native limestone forest that provides habitat for native forest species. • 72-acre (29-ha) marine unit, which includes Pugua Patch Reef (or Double Reef), a valuable fringing reef, providing a nursery for marine species of commercial and recreational fishery value.
Orote Peninsula ERA	30 (12)	Yes[(5)]	Established to protect two biological units: • 30-acre (12-ha) terrestrial unit encompasses a remnant native limestone forest that provides habitat for native forest species. • 133-acre (54-ha) marine unit provides nursery for marine species of commercial and recreational fishery value.

Table 3.8.1-2. Guam Terrestrial Conservation Areas

Name	*Area (acres [ha])*	*Management Plan*	*General Description*
Pati Point Natural Area[7]	750 (303)	No	The primary purpose of the natural area is to protect the natural diversity of the native flora and fauna, and serve as an outdoor classroom for research. Access to the area is highly restricted to protect the natural resources, and is allowed only with the permission of AAFB.
Ungulate Exclosures[6]	628 (254)	No	Conservation measures from the ROD and section 7 consultation for proposed establishment and operation of an Intelligence, Surveillance, and Reconnaissance, and Strike Capability at AAFB NWF.
Habitat Management Unit (HMU)[6]	135 (55)	No	
USGS Brown Treesnake Research Exclosure[3]	12 (4.8)	No	The USGS Brown Treesnake Project has been conducting research pertaining to brown treesnake population dynamics and life history, as well as brown treesnake barrier technology on AAFB.

Notes: *362.8 acres (146.8 ha) is designated critical habitat for the Mariana crow, Mariana fruit bat, and Guam Micronesian kingfisher (USFWS 2004a, 2014b).
Sources: [1]GDAWR 2006; [2]USFWS 2009a, b; [3]JRM 2013; [4]NAVFAC Marianas 2010a; [5]NAVFAC Marianas 2010b; [6]USFWS 2006; [7]AAFB 2008.

Guam NWR, Critical Habitat, and Overlay Refuge Lands

The Guam NWR was established in 1993 in response to the 1984 listing of six species as endangered pursuant to the ESA. In 2004, the USFWS designated critical habitat under the ESA for three of these species: Mariana fruit bat, Guam Micronesian kingfisher, and Mariana crow. The terrestrial portion of the Guam NWR (Ritidian Unit) is the only designated critical habitat on Guam for these three species.

The purpose for which a refuge is established or acquired is of key importance in refuge planning. Purposes form the foundation for planning and management decisions. The purposes of a refuge are specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit. At the time of establishment, USFWS policy did not require a notice to be posted in the Federal Register. According to the USFWS, the best record regarding establishment of the Guam NWR is the *Final Environmental Assessment for the Proposed Guam National Wildlife Refuge* and associated Finding of No Significant Impact (USFWS 2009c). The Guam NWR's authorizing authorities most relevant to the four principle reasons the Guam NWR was established are the ESA, Fish and Wildlife Act, Migratory Bird Conservation Act (now known as Migratory Bird Treaty Act), and Refuge Recreation Act. Drawing from this record and USFWS (2009c), the purposes of the Guam NWR (Ritidian Unit) are:

- "…to conserve (A) fish or wildlife which are listed as endangered species or threatened species under the ESA, or (B) plants…" 16 USC § 1534 (ESA).
- "…for the development, advancement, management, conservation, and protection of fish and wildlife resources…" 16 USC § 742f(a)(4) (Fish and Wildlife Act of 1956).
- "…for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 USC § 715d (Migratory Bird Conservation Act).

- "…suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species…" 16 USC § 460k-460k-4 (Refuge Recreation Act, as amended).

In 1994, Cooperative Agreements were signed between the Navy, Air Force, and USFWS to establish an Overlay Refuge (Air Force and USFWS 1994; DON and USFWS 1994). The 1994 Cooperative Agreements document a commitment by the Navy, Air Force, and USFWS for a coordinated program centered on the protection of endangered and threatened species and other native flora and fauna, maintenance of native ecosystems, and the conservation of native biological diversity in cooperation with GDAWR, recognizing that the primary purpose of lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force. The Overlay Refuge includes approximately 21,690 acres (8,778 ha) on lands administered by the DoD.

The purposes of the Overlay Refuge lands (Navy and Air Force Overlay Units) are separate from the purposes of the Ritidian Unit. The following purposes for the Overlay Refuge units are specified in the establishing Cooperative Agreements (Air Force and USFWS 1994; DON and USFWS 1994; USFWS 2009c):

- "…to conserve (A) fish or wildlife which are listed as endangered species or threatened species…or (B) plants… (C) the ecosystems upon which endangered species and threatened species depend..." 16 USC § 1534 (ESA).
- "…shall be administered by him (Secretary of the Interior) directly or in accordance with cooperative agreements… and in accordance with such rules and regulations for the conservation, maintenance, and management of wildlife, resources thereof, and its habitat thereon..." 16 USC 664 (Fish and Wildlife Coordination Act).
- "…for the development, advancement, management, conservation, and protection of fish and wildlife resources" 16 USC § 742f(a)(4) (Fish and Wildlife Act of 1956).
- "…for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude, if such terms are deemed by the Secretary to be in accordance with law and compatible with the purposes for which acceptance is sought." 16 USC § 742f(b)(1) (Fish and Wildlife Act of 1956).
- "…(1) Incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species and threatened species." 16 USC 460k-l (Refuge Recreation Act).
- "…the Secretary…may accept and use…donations of…real…property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by the donors..." 16 USC 460k-2 (Refuge Recreation Act).
- "To ensure that (Air Force and Navy) lands within the Guam National Wildlife Refuge remain available for the use of the (Air Force and Navy) to carry out its responsibilities to organize, supply, equip, train, service, mobilize, demobilize, administer, and maintain forces." 10 USC 8013.

As discussed previously, in October 2004, the USFWS designated 362.8 acres (146.8 ha) of land as critical habitat for the Guam Micronesian kingfisher, Mariana crow, and Mariana fruit bat on the Ritidian Unit of the Guam NWR in northern Guam (USFWS 2004a). Overlay Refuge lands were excluded from this designation in northern and southern Guam. Air Force lands were excluded under section 4(a)(3) of the ESA based on the Air Force's Integrated Natural Resources Management Plan (INRMP) for AAFB.

The DON lands were excluded under section 4(b)(2) of the ESA based upon a determination by the Secretary of Interior that the benefits of excluding these lands, including benefits to national security and existing management plans and conservation efforts, outweighed the benefits of designating them as critical habitat.

3.8.1.3 Wildlife

For the purposes of this SEIS, this category includes invertebrates, fish, amphibians, reptiles, mammals, and birds, including native bird species protected under the Migratory Bird Treaty Act (MBTA), with the exception of those special-status species described in Section 3.8.1.4 below.

To address the importance and problems associated with the introduction of non-native species to Guam and their impacts on native species, the wildlife discussion addresses both native and non-native species. Brief descriptions and life history information for wildlife species of special interest can be found in the 2010 Final EIS (Volume 9, Appendix G, Chapter 2: Biological Resources, Section 2.2.1: Species Profiles, pages G-2-3 to G-2-36).

A major factor in the current occurrence and distribution of all wildlife, including ESA- and Guam-listed species, is the presence of the brown treesnake. The brown treesnake impacts the economy, human health, and island ecology of Guam. It should be noted that the presence of the brown treesnake effectively eliminates much of the existing undeveloped areas on Guam as suitable habitat for native wildlife species, particularly special-status species. Further information on the brown treesnake is provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.1.2: Wildlife, pages 10-6 to 10-7).

3.8.1.4 Special-Status Species

Special-status species include: (1) those species listed as threatened or endangered, and associated critical habitat, under the federal ESA; (2) species proposed for ESA listing; (3) those designated by legislative authority in the Territory of Guam as endangered or threatened under the Guam ESA; and (4) Species of Greatest Conservation Need (SOGCN) as identified in Guam's Comprehensive Wildlife Conservation Strategy (CWCS). Brief descriptions and life history information for ESA-listed and proposed species, and Guam-listed species can be found in the 2010 Final EIS (Volume 9: Appendix G, Chapter 2: Biological Resources, Section 2.2.1: Species Profiles, pages G-2-3 to G-2-36).

3.8.2 Regulatory Framework

3.8.2.1 Federal ESA (16 USC §§ 1531-1544)

Enacted in 1973, the purpose of the ESA is to conserve the ecosystems upon which endangered and threatened species depend and to provide a program for the conservation of such endangered and threatened species. *Endangered species* "means any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary (of Interior or Commerce, as appropriate) to constitute a pest whose protection under the provisions of this chapter would present an overwhelming and overriding risk to man" (16 USC § 1532(8))." *Threatened species* "means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 USC § 1532(20)). section 7 of the ESA outlines the procedures for federal interagency cooperation to conserve federally listed species and designated critical habitat.

Section 7 Consultation Process

Section 7(a)(2) imposes upon federal agencies a procedural and substantive obligation whenever they authorize, fund, or implement an action. Federal agencies comply with the legal requirements of section 7(a)(2) and the implementing regulations, when triggered, by consulting with the USFWS or NMFS, as appropriate, and avoiding those actions that are likely to jeopardize listed species or adversely modify those species' designated critical habitat (16 USC § 1536(a)(2)). In fulfilling these requirements, each agency shall use the best scientific and commercial data available.

Jeopardy

Under the USFWS's implementing regulations, "jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR § 402.02). While the jeopardy analysis requires considering both the likely effect of the proposed action on the survival of the species as well as the likely effect on recovery, in exceptional circumstances, impacts to recovery alone could warrant a jeopardy finding. As further discussed in this section below, the BO issued by the USFWS must contain a determination of whether the effects of the proposed action, taken together with cumulative effects, are likely to jeopardize the species as a whole (50 CFR § 402.14(g)(4)).

Adverse Modification of Critical Habitat

Critical habitat is defined in section 3 of the ESA as specific areas that are within or outside the geographic area occupied by a species at the time it is listed that contain physical or biological features essential to the conservation of the species, and that may require special management considerations or protection (16 USC § 1532(5)). Current regulations promulgated by the USFWS and NMFS defined "destruction or adverse modification" as "direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical" (50 CFR § 402.02). Section 7(a)(2) of the ESA does not bar the mere loss of some critical habitat, unless the loss satisfies the statutory threshold. Interpretation of the legal standard for determining adverse modification is problematic; however, as a result of federal appellate court decisions which have struck down the current regulatory definition of "destruction or adverse modification." Therefore, referring back to ESA, adverse modification can occur when the proposed action appreciably reduces the likelihood of species recovery. While the USFWS and NMFS have not yet revised this regulatory definition in light of these court decisions, the USFWS has issued the following interim guidance which underlies the relevant analysis in Chapter 5 of this SEIS:

- Discuss the entire designated critical habitat area in terms of the biological and physical features that are essential to the conservation (discussion of "survival" in this and other sections of the adverse modification analysis is not appropriate) of the species. The analysis should identify and discuss the primary constituent elements of the critical habitat.
- Describe how the primary constituent elements essential to the conservation of the species are likely to be affected and, in turn, how that will influence the function and conservation role of the affected critical habitat unit.
- Discuss whether, with implementation of the proposed federal action, critical habitat would remain functional (or retain the current ability for the primary constituent elements to be functionally established) to serve the intended conservation role for the species (USFWS 2004b).

Informal and Formal Consultation

The consultation process is divided into informal and formal consultation. The informal consultation process: (1) clarifies whether and what listed, proposed species or designated or proposed critical habitats may be in the action area; (2) determines what affect the action may have on these species or critical habitat; (3) explores ways to modify the action to reduce or remove adverse effects to the species or critical habitats; (4) determines the need to enter into formal consultation for listed species or designated critical habitat, or conference for proposed species or proposed critical habitats; and (5) explores the design or modification of an action to benefit the species. If a federal agency determines through the informal consultation process, through its own analysis, or the preparation of a BA, that its proposed action is likely to adversely affect listed species or critical habitat, then formal consultation is required. Formal consultation is a process between the regulator and the federal agency that commences with the federal agency's written request for consultation under ESA section 7(a)(2) and concludes with the regulator's issuance of a BO under ESA section 7(b)(3).

In order to evaluate the effects of a proposed action on a listed species or critical habitat, a federal agency must initially determine what species or critical habitat is/are present in the action area. The action area comprises "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR § 402.02)." For major construction activities such as the proposed action in this SEIS, the DON must communicate with USFWS or NMFS, as appropriate, in writing to identify the species that are present in the action area. As part of this identification process for the proposed action, the DON and the USFWS discussed whether the section 7 consultation process should continue to include those ESA-listed species which are extirpated from the action area, which in this instance comprises the entire island of Guam. The USFWS defines an extirpated species as a species no longer surviving in regions that were once part of its range (USFWS 2013c). However, they are not extinct and exist in other parts of the world; they may also be found in zoos or aquaria.

The DON initiated this discussion given its inability to identify any legal authority which would require consultation on extirpated listed species. Acknowledging that current regulations and published USFWS guidance do not specifically address extirpated species, the USFWS advised the DON that consultation on effects to currently extirpated species is not unprecedented and is appropriate in this instance as the effects of the proposed action are likely to persist and overlap the period when reintroduction of the currently extirpated species on Guam is reasonably certain to occur and the species are likely to be exposed to the effects of the proposed action should it be implemented. The USFWS further noted that the situation regarding the proposed action could be distinguished from a project that would be completed in the near term and where the effects of the action are not likely to persist and overlap the period when reintroduction of the currently extirpated species is reasonably certain to occur. In such instances, consultation may not need to include extirpated species.

On September 8, 2010, the USFWS issued its BO for the preferred alternative in the 2010 Final EIS (USFWS 2010a). In April 2013, the DON requested reinitiation of consultation on that 2010 BO and prepared a BA analyzing the potential impacts on ESA-listed species and designated critical habitat under the jurisdiction of the USFWS from DON actions addressed in the 2010 Final EIS which remain final under the September 2010 ROD and either are under construction or could begin construction prior to completion of this SEIS and the issuance of a new ROD (expected in 2015) (DON 2013). As stated in Chapters 1 and 2 of this SEIS, based on adjustments proposed in the Marine Corps realignment plans, the DoD adopted a new force posture in the Pacific providing for a materially smaller force on Guam. Those adjustments prompted the DON's review of the major actions previously planned for Guam, as assessed in

the 2010 Final EIS, and approved in the ROD and addressed in the 2010 BO. This review concluded that while some actions remain unchanged as a result of the smaller force size, others, such as the cantonment and family housing areas, could significantly change as a result of the modified force. The DON has opted to reinitiate section 7 consultation with the USFWS for both those actions which remain final (i.e., 2010 ROD) and not subject to further analysis and those actions which are part of the 2012 Roadmap Adjustments (this SEIS).

As a result of the proposed action assessed in this SEIS (which modifies the action addressed in the 2010 BO), the DON will reinitiate section 7 consultation with the USFWS. As part of the SEIS process, the DON will prepare a BA in accordance with section 7 of the ESA to analyze the potential impacts of the proposed action on ESA-listed species and critical habitat. A BA is information prepared by, or under the direction of, a federal agency (e.g., the DON) to determine whether a proposed action is likely to: (1) adversely affect listed species or designated critical habitat; (2) jeopardize the continued existence of species that are proposed for listing; or (3) adversely modify proposed critical habitat (50 CFR § 402.02 and § 402.12). For the BA, the DON will adopt the analytical framework set forth in the BO issued by the USFWS for the preferred alternative in the 2010 Final EIS (USFWS 2010a). This framework is discussed in Section 3.1.3.2 below. The USFWS will then issue a BO which will include: (1) the opinion of the USFWS as to whether or not a federal action is likely to jeopardize the continued existence of listed species, or result in the destruction or adverse modification of designated critical habitat; (2) a summary of the information on which the BO is based; and (3) a detailed discussion of the effects of the action on listed species and designated critical habitat (50 CFR § 402.02 and § 402.14(h)).

Candidate Species

A *candidate species* is a plant or animal species for which the USFWS has sufficient information on file regarding biological vulnerability and threats to support a proposal to list it as endangered or threatened under the ESA but has not yet developed a proposed listing regulation based on the most recent candidate review (USFWS 2013b). As a result of litigation, the USFWS has developed a multi-year listing work plan (work plan) for species listed on the 2010 Candidate Notice of Review to determine if they should be added to the Federal Lists of Endangered and Threatened Wildlife and Plants (USFWS 2013a). The work plan lists six species for Guam, four of which currently occur on Guam (i.e., Mariana eight-spot butterfly, fragile tree snail, Guam tree snail, and humped tree snail) and two that are extirpated and do not currently occur on Guam (i.e., Pacific sheath-tailed bat [USFWS 2012a] and Mariana wandering butterfly [USFWS 2012b]) (USFWS 2013a). The USFWS work plan specifies that these species will be proposed for listing (if warranted) and designation of critical habitat will be proposed (if prudent and determinable) in FY 2014 and a final listing and critical habitat determination in FY 2015 (USFWS 2013a). The USFWS proposed the listing of the above species, as well as a number of plant species, under the ESA in October 2014 (USFWS 2014a). The BA, prepared by the DON for the proposed action, will address these proposed species.

3.8.2.2 Guam ESA (Guam Public Law 15-36; 5 Guam Code Annotated § 63205(c)) and Comprehensive Wildlife Conservation Strategy

The Guam ESA was passed on June 18, 1979, and provides protection to both Guam-listed and federally listed threatened and endangered species on Guam. The purpose of the Guam ESA is to protect ecosystems that provide habitat to threatened and endangered species and provide a conservation program for such species.

Guam has also prepared a CWCS that identifies SOGCN on Guam. The primary goal of the CWCS is to provide for the effective management, preservation, protection, and restoration of the island's natural resources, especially SOGCN, now and for the future. The GDAWR is the lead agency in the management of Guam's natural resources. This includes all management activities associated with aquatic and terrestrial fauna (GDAWR 2006).

3.8.2.3 Migratory Bird Treaty Act (16 USC §§ 703-712)

The MBTA of 1918 is the primary legislation in the U.S. established to conserve migratory birds. The MBTA prohibits the taking, killing, or possessing of migratory birds unless permitted by regulation. It implements the U.S.' commitment to four bilateral treaties, or conventions, for the protection of a shared migratory bird resource. The prohibition applies to birds included in the respective international conventions between the U.S. and Great Britain, the U.S. and Mexico, the U.S. and Japan, and the U.S. and the Soviet Union (now Russia). The current list of species protected under the MBTA was released in March 2010 (USFWS 2010c).

For migratory birds, the MBTA prohibits the taking, killing, or possession of migratory birds unless permitted by regulation. The FY 2003 NDAA provides that the Secretary of the Interior shall exercise his/her authority under the MBTA to prescribe regulations to exempt the Armed Forces from the incidental taking of migratory birds during military readiness activities authorized by the Secretary of Defense. The final rule authorizing the DoD to take migratory birds during military readiness activities was published in the Federal Register on February 28, 2007.

Congress defined military readiness activities as all training and operations of the Armed forces that relate to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. Military readiness activities do not include: (A) routine operation of installation support functions such as administrative offices, military exchanges, water treatment facilities, schools, housing, storage facilities, and morale, welfare, and recreation activities; (B) the operation of industrial activities; and (C) the construction or demolition of facilities used for a purpose described in A or B (50 CFR Part 21). For the purposes of this SEIS, the operation of the proposed LFTRC is considered a military readiness activity.

Migratory bird conservation relative to non-military readiness activities is addressed separately in a Memorandum of Understanding (MOU) developed in accordance with EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*. The MOU between the DoD and USFWS was signed in July 2006 and DoD responsibilities included, but are not limited to: (1) incorporating conservation measures addressed in regional or state bird conservation plans and INRMP; (2) managing military lands and activities other than military readiness in a manner that supports migratory bird conservation; and (3) avoiding or minimizing impacts to migratory birds, including incidental take and the pollution or detrimental alteration of the environments used by migratory birds. For the purposes of this SEIS, the construction and operation of the proposed cantonment/family housing area and the construction of the LFTRC are considered non-military readiness activities.

3.8.2.4 EO 13112, Invasive Species

This EO addresses responsibilities and initiatives of the federal government for controlling non-native invasive species. Therefore, these species are included as a significant component of vegetation and wildlife in this SEIS.

3.8.3 Approach to Analysis

3.8.3.1 Methodology

Study Areas

The biological resources action areas for this SEIS are listed in Table 3.8.3-1. Project-specific biological surveys were conducted within areas that lacked sufficient and current data in order to evaluate potential impacts for this SEIS. Surveys were conducted at representative locations within the action areas and findings from these representative locations are assumed to be representative of other areas not surveyed that possess similar habitat attributes.

Data Sources and Surveys

Key sources of information for this section include the 2010 Final EIS; the JRM INRMP (JRM 2013); the Guam CWCS (GDAWR 2006); and previous EISs, Environmental Assessments, BAs, and resulting USFWS BOs for recent actions on military lands on Guam. In addition, information from site-specific surveys conducted for the 2010 Final EIS (NAVFAC Pacific 2010a) and project-specific biological and wetland surveys for this SEIS (NAVFAC Pacific 2013a, 2013b, 2013c, 2013d) were used. Site-specific natural resources GIS data for the project areas were obtained from NAVFAC Pacific and NAVFAC Marianas as of April 2013.

Table 3.8.3-1. Project-specific Terrestrial Biological Resources Field Studies within Proposed Project Locations

Project Location	*Biological Resource*						
	Vegetation	*Tree Snails*	*Reptiles & Amphibians*	*Birds*	*Fruit Bat*	*Butterflies*	*Wetlands*
Cantonment and Housing							
Finegayan	✓	✓#	✓	✓	✓	#	*
South Finegayan	✓	#	✓#	✓	*	#	*
AAFB	#	#	#	^	^	#	*
North Barrigada	✓	✓#	✓	✓	^	#	#
South Barrigada	^	#	✓	✓#	*	#	#
Live-Fire Training Ranges							
Route 15 Lands	✓	✓#	✓	✓	✓#	✓#	*
NAVMAG (East/West)	#	#	#	#	#	#	#
NAVMAG (North/South)	✓#	#	✓#	✓#	#	#	#
NAVMAG (L-Shaped)	✓#	#	✓#	✓#	#	#	#
AAFB NWF	#	#	#	✓#	^	#	*
Andersen South (HG Range)	✓	✓#	✓	✓	#	✓#	*

Notes: ✓ = surveys conducted for the 2010 Final EIS.
= surveys conducted for this SEIS.
* = resource not present based on previous studies or knowledge.
^ = other data sources were adequate.

Impact Analysis

Biological resource issues and concerns include the potential direct, indirect, and cumulative impacts of the alternatives during the construction and operation phases. Impacts may be either temporary (reversible) or permanent (irreversible). Direct and indirect impacts are distinguished as follows; cumulative impacts are defined and discussed in detail in Chapter 7.

Direct impacts are associated with proposed construction activities (e.g., ground-disturbing activities) and operations (e.g., live-fire range use). Potential types of direct impacts include, but are not limited to:

- Permanent loss of habitat due to vegetation removal during construction.
- Noise, lighting, or human activity that could temporarily prevent a wildlife or special-status species from occupying otherwise suitable habitat.
- Injury or mortality to wildlife or special-status species caused by the action that occur at the same time and place as the action.

Direct impacts from ground disturbance and vegetation clearing was assumed within all areas labeled as "Impacted Area" on figures in Sections 2.3 and 2.4 depicting the project components.

Indirect impacts are caused by the action and are later in time, or farther removed in distance but still reasonably foreseeable. Potential indirect impacts include, but are not limited to:

- Introduction of new non-native, invasive species or increased dispersal of existing non-native, invasive on Guam.
- Dispersal of existing non-native, invasive species from Guam to the CNMI, Hawaii, or other areas.
- Growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Potential direct impacts of noise from live-fire ranges and munitions detonations were determined based on sound levels estimated from an operational noise assessment of the proposed LFTRC conducted by the Department of the Army (Army 2013). MCO 3550.11, *Range Air Installations Compatible Use Zone Program (RAICUZ)*, states that DNL should be used to generate ordnance noise contours. The noise simulation program used to assess small arms weapons noise is the SARNAM. For further discussion of noise, noise metrics, and noise modeling used in the analysis in this SEIS, see Section 3.4, *Noise*.

General principles used to evaluate impacts are:

- The extent, if any, that the action would result in substantial loss or degradation of habitat or ecosystem functions (natural features and processes) essential to the persistence of native flora or fauna populations.
- The extent, if any, that the action would permanently lessen ecological habitat qualities that special-status species depend upon, and which partly determines the species' prospects for conservation and recovery.
- The extent, if any, that the action would diminish the population size, distribution, or habitat of regionally important native plant or animal species.
- The extent, if any, that the action would be likely to jeopardize the continued existence in the wild of any federally listed species or adversely modify designated critical habitat.
- The extent, if any, that the action would be inconsistent with the goals of the JRM INRMP.

3.8.3.2 Impact Assessment Criteria

Significance of impacts to vegetation, wildlife, and special-status species was determined using guidelines in the previous section. Special-status species are defined as ESA- and Guam-listed species and species that are proposed for federal ESA listing that still occur on Guam in the wild. Specific significance criteria are discussed below. If significant impacts are determined, then mitigation may be proposed to offset the impacts.

Vegetation

Significance of impacts to vegetation will be based on the extent of clearing and context within the surrounding landscape. Impacts would be determined significant if primary limestone forest, secondary limestone forest, primary ravine forest, or vegetated wetland communities were cleared, unless determined to be insubstantial in the context of the surrounding vegetation. Limestone and ravine forests in particular are important since they retain the functional components of native forest that provide habitat for native species, particularly special-status species. In addition to the loss of seed dispersers (e.g., native birds) due to the introduction of the brown treesnake, the loss of limestone and ravine forest communities due to development and introduction of non-native plant and animal species (e.g., deer and carabao) has also been a reason for the decline of native species on Guam.

Terrestrial Conservation Areas

Impacts would be considered significant if currently designated terrestrial conservation areas are cleared unless areas cleared are less than significant in the context of the surrounding land use and based on the size of the impacted area relative to the total size of the terrestrial conservation area. In addition, impacts would be considered significant if direct or indirect impacts to a terrestrial conservation area result in the loss or significant diminishment of the original reason for the establishment of the terrestrial conservation area.

Wildlife

To identify potential impacts to wildlife, the activities associated with the proposed action were considered in the context of affected species' life history (e.g., nesting behavior and habitat, foraging habitat, and mobility and migration). If a planned action was identified as having an adverse effect on the habitat or population of a particular species (defined as a physical loss of or exclusion from required habitat, or death of individuals), the effect was qualitatively assessed based on information from published scientific literature and the professional experience of subject matter experts to determine whether the effect would be substantial enough to constitute a significant impact.

Impacts would be determined significant if native wildlife species are present and the proposed project would result in measurable changes in population sizes or distributions of regionally important native wildlife species (excluding special-status wildlife species which are addressed separately below). Potential impacts due to non-native invasive species that exceed the general principles specified above are also considered. Historical impacts from non-native species have been severe, particularly from the brown treesnake. Although the proposed action would not result in additional impacts from brown treesnake on Guam, the concern is that the brown treesnake would be inadvertently introduced to other islands throughout the Pacific. This concern is addressed comprehensively within subsequent terrestrial biological resource sections in this SEIS.

The proposed action was evaluated for potential impacts to wildlife associated with the following:

- Loss of vegetation or wildlife habitat identified as declining or rare in the region.
- Loss or long-term disruption of a regionally important wildlife movement corridor.
- Removal or degradation of a natural community or ecosystem that would substantially impact the size or distribution of native plant and wildlife populations.

Migratory Birds. The 2007 final rule authorizing the DoD to take migratory birds during military readiness activities provides that the Armed Forces must confer and cooperate with the USFWS on the development and implementation of conservation measures to minimize or mitigate adverse effects of a

military readiness activity if it determines that such activity may have a significant adverse effect on a population of a migratory bird species. An activity has a significant adverse effect if, over a reasonable period of time, it diminishes the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem. Assessment of impacts should take into account yearly variations and migratory movements of the impacted species.

Assessment of the effects of non-military readiness activities on migratory birds is addressed separately in a 2006 MOU between the USFWS and DoD developed in accordance with EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*.

Special-Status Species

In accordance with section 7 of the ESA, the DON will prepare a BA and conduct appropriate consultation with the USFWS to assess potential impacts to ESA-listed species, species proposed for listing under the ESA, and designated critical habitat. Analyses of potential impacts are based on review of plans for the proposed action and the available current and historical distributional data for each species. For the BA and this SEIS, the DON will adopt the analytical framework set forth in the 2010 BO for the preferred alternative identified in the 2010 Final EIS. This framework is based upon the recovery habitat concept, which for the proposed action the USFWS has generally defined as habitat that is currently suitable to support the recovery of listed species (USFWS 2010a, 2010b). In discussing the current status and baseline for each listed species on Guam, the USFWS identified the recovery habitat separately for each species (Figures 3.8.3-1 and 3.8.3-2).

The framework to identify suitable recovery habitat involves a number of steps, and is best explained using the Guam Micronesian kingfisher, an extirpated species, as an example (USFWS 2010a).

- Drawing from the species recovery plan which identified 1,000 birds in the north and south of Guam as one criterion for recovery, the USFWS determined the number of breeding pairs needed to maintain a subpopulation of 1,000 adults. Based upon an assessment of juvenile, breeding pair, and non-paired population requirements, the USFWS concluded that 500 pairs would be needed in the north and south of Guam to meet recovery requirements, and that a population of at least 690 juveniles was needed to replace lost adults.
- The USFWS then determined the amount of territory needed by a single breeding pair, and that the amount of space required by juvenile kingfishers was within the area required by a breeding pair.
- Multiplying the amount of acreage need by a single breeding pair by the number of pairs needed to maintain a subpopulation of 1,000, the USFWS concluded that 12,355 acres (5,000 ha) were needed separately in the north and south of Guam to support species recovery.
- Recognizing, however, that habitat on Guam can be lost as a result of typhoon impacts, the USFWS assessed the amount of forest that would be lost over the estimated 20-year period it would take for forest to recuperate from a typhoon and be sufficient for kingfisher breeding. Based upon this estimation and an estimate of the average number of typhoons that would impact Guam over a 20-year period, the USFWS concluded that an additional 780 acres (316 ha) of habitat in the north and south of Guam would be needed as a typhoon buffer to ensure recovery.
- Adding the 780 acres (316 ha) needed as a typhoon buffer to the 12,355 acres (5,000 ha) needed to support species recovery led USFWS to conclude that a minimum total of 13,134 acres (5,315 ha) in the north and south of Guam was required to support recovery of the kingfisher (Table 3.8.3-2).



Figure 3.8.3-1
Recovery Habitat for Guam Micronesian Kingfisher, Mariana Crow, and Mariana Fruit Bat

Source: USFWS 2010b

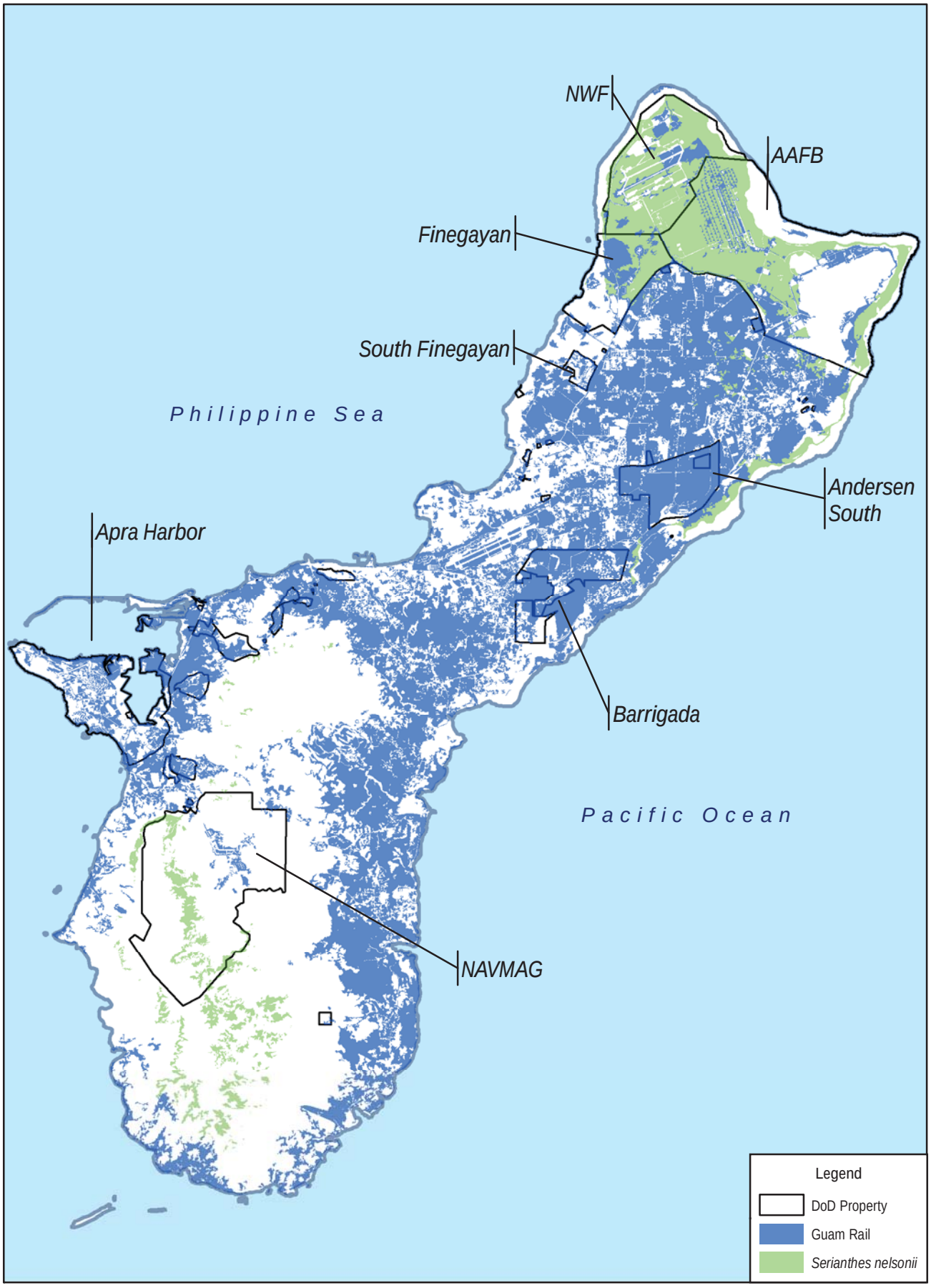


Figure 3.8.3-2
Recovery Habitat for Guam Rail and *Serianthes nelsonii*

- Using a 2006 island-wide assessment of land cover completed by the USFS, the USFWS determined the amount of available kingfisher recovery habitat in the north of Guam to be 15,822 acres (6,403 ha), and 13,488 acres (5,458 ha) in the south.
- Subtracting the amounts of acreage needed to support recovery from the amount of available recovery habitat resulted in a determination of the amount of remaining kingfisher recovery habitat above the minimum threshold level necessary for species recovery: 2,688 acres (1,088 ha) in the north and 354 acres (143 ha) in the south.
- From this amount of remaining recovery habitat above the minimum threshold, the USFWS subtracted the amounts of recovery habitat within the 2010 Final EIS proposed action's vegetation clearing footprint and likely to be cleared as a result of interdependent/interrelated civilian development. This was used to determine the amount of recovery habitat remaining, if any, after project completion above the minimum threshold necessary for species recovery: 815 acres (330 ha) in the north and 343 acres (139 ha) in the south.
- Since sufficient kingfisher recovery habitat would remain post-project to support recovery, the USFWS concluded that the proposed action would not jeopardize the continued existence of the Guam Micronesian kingfisher.

Table 3.8.3-2 summarizes the results of the various recovery habitat determinations as presented in the 2010 BO (USFWS 2010a). The analysis of potential impacts to special-status species presented in Chapters 4 and 5 of this SEIS is based upon the above analytical framework, and the use of "recovery habitat" as a metric must be interpreted in this context.

Table 3.8.3-2. Potential Impacts to ESA-Listed Species Recovery Habitat on Guam as Assessed in the 2010 USFWS BO

	Guam Micronesian Kingfisher		***Guam Rail***		***Mariana Crow***		***Mariana Fruit Bat***	
	Acres	***Ha***	***Acres***	***Ha***	***Acres***	***Ha***	***Acres***	***Ha***
Current Recovery Habitat Remaining								
Northern Guam	15,822	6,403	49,564	20,058	14,831	6,002	15,577	6,304
Southern Guam	13,488	5,458			11,819	4,783	13,731	5,557
Total Necessary for Species Recovery								
Northern Guam	13,134	5,315	41,184	16,668	7,463	3,020	Not Determined	
Southern Guam	13,134	5,315			7,463	3,020		
Amount of Remaining Recovery Habitat above Minimum Threshold Level Necessary for Species Recovery								
Northern Guam	2,688	1,088	8,380	3,390	7,368	2,982	Not Determined	
Southern Guam	354	143			4,356	1,763		
Recovery Habitat within Project Vegetation Clearing Footprint								
Northern Guam	1,520	615	1,317	533	1,518	614	1,520	615
Southern Guam	4	2			4	2	4	2
Recovery Habitat Likely to be Cleared as a Result of Interdependent/Interrelated Civilian Development								
Northern Guam	353	143	2,635	1,066	313	127	353	143
Southern Guam	6	2			6	2	6	2
Percent of Recovery Habitat to be Cleared as a Result of the Direct and Indirect Project Effects								
Northern Guam	11.8%		8.0%		12.3%		12.0%	
Southern Guam	0.1%				0.1%		0.1%	
Recovery Habitat Remaining after DOD and Indirect Civilian Development are Completed								
Northern Guam	13,949	5,645	45,612	18,459	13,001	5,261	13,704	5,546
Southern Guam	13,477	5,454	0	0	11,810	4,779	13,720	5,552

Table 3.8.3-2. Potential Impacts to ESA-Listed Species Recovery Habitat on Guam as Assessed in the 2010 USFWS BO

	Guam Micronesian Kingfisher		***Guam Rail***		***Mariana Crow***		***Mariana Fruit Bat***	
	Acres	***Ha***	***Acres***	***Ha***	***Acres***	***Ha***	***Acres***	***Ha***
After Project Completion - Amount of Recovery Habitat above Minimum Threshold Necessary for Species Recovery								
Northern Guam	815	330	4,428	1,791	5,538	2,241	Not Determined	
Southern Guam	343	139			4,347	1,759		

Source: USFWS 2010a.

The proposed action was also evaluated for potential impacts to special-status species associated with the following:

- Loss or long-term disruption of a regionally important corridor for the movement of special-status species.
- Removal or degradation of a natural community or ecosystem that would substantially impact the size or distribution of special-status species.

3.8.3.3 Public Scoping Issues

The scoping comments/concerns regarding terrestrial biological resource are summarized as follows:

- Impacts to ESA- and Guam-listed species: *Serianthes nelsonii* tree (hayan lagu), Mariana common moorhen (pulattat), Mariana fruit bat (fanihi), Guam rail (ko'ko') (extirpated), Guam Micronesian kingfisher (sihek) (extirpated), Mariana crow (aga) (extirpated), Mariana swiftlet (chachaguak**)**, Micronesian starling, and green and hawksbill sea turtle (hågan) nesting beaches.
- Potential impacts to species that are candidates for listing under the federal ESA: Mariana eight-spot butterfly, Mariana wandering butterfly (extirpated), and tree snails.
- Potential impacts to rare plant species: *Tabernaemontana rotensis*, *Intsia bijuga* (ifit), and *Bikkia tetramdra* (gausali).
- Minimization and mitigation measures for protected species.
- NWF LFTRC alternative would impact Guam NWR by closure of the Guam NWR for 39 weeks per year.
- Limiting access by researchers and USFWS and GDAWR staff for reasonable and effective refuge management and monitoring activities.
- Impeding the purpose of the completed predator, brown treesnake fence around a 12-acre (5-ha) area and continued monitoring of its effectiveness.
- Encroaching onto 239 acres (97 ha) of USFWS-designated critical habitat.
- The proposed action would hamper efforts and plans for reintroduction of Guam rail and Micronesian megapode (sasangat) (both extirpated).
- Potential impacts and access restrictions to designated critical habitat areas, Guam NWR, and existing ERAs.
- Potential impacts to GDAWR natural resource activities including various forest bird surveys, threatened and endangered species monitoring, predator and ungulate control, sea turtle nest monitoring, research and education, particularly in the ERAs and Guam NWR.
- Potential impacts to past and ongoing recovery and brown treesnake interdiction efforts.

- Concerns relative to biosecurity; feral cats, rodent control, and feral ungulates; brown treesnake risks in light of increased air/sea cargo (both military and civilian) and threat to economy and ecology of CNMI, Hawaii, and Pacific Region; and how the Micronesia Biosecurity Plan would be used.
- Potential impacts associated with the NAVMAG LFTRC alternatives from wildfires associated with live-fire training activities and publicly accessible roads.
- Potential impacts to visitors and wildlife from noise during live-fire exercises.

3.9 MARINE BIOLOGICAL RESOURCES

3.9.1 Definition

This SEIS defines marine biological resources as those marine-related organisms (marine flora and fauna), their behaviors, and their interactions with the environment that may be directly or indirectly affected by the proposed action within the marine ROI previously established in the 2010 Final EIS as the nearshore waters of Guam out to the 164-foot (50-m) isobath. Described in detail in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1: Affected Environment, pages 11-1 to 11-68), marine biological resources within the established marine ROI are divided into the following five major categories for analysis throughout this SEIS: marine flora and invertebrates, fish, EFH, special-status species, and marine conservation areas.

A separate category for non-native species was identified in the 2010 Final EIS. However, information is generally lacking for non-native marine species around Guam. The proposed action is not expected to contribute to the introduction or transport of non-native marine species around Guam due to standardized BMPs (i.e., hull management and ballast water policies) as well as the implementation of standard biosecurity measures (e.g., Hazard Analysis and Critical Control Points [HACCP], outreach/education, and monitoring to evaluate the effectiveness of HACCPs) into construction protocols, procedures, and activities. Non-native species will not be discussed further in the marine biological resources sections in this SEIS.

3.9.1.1 Marine Flora and Invertebrates

Marine flora and invertebrates include macroalgae (seaweeds), seagrasses, emergent vegetation (plants that are rooted in the substrate beneath the water but grow tall enough to protrude above or have leaves that float on the water), gastropods (snails), cephalopods (squid and octopus), crustaceans (lobsters and crabs), sponges, and corals. These taxa may themselves be managed species (particularly coral, mollusks, and crustaceans) or they may be deemed necessary for the sustainability of managed fisheries and classified as EFH (Section 3.9.1.3).

3.9.1.2 Fish

Fish abundance and biodiversity, especially for regionally important native fish species, are described for the affected environment for each alternative, and are assessed primarily in terms of recreational and commercial fishing. In terms of habitat requirements, fisheries are discussed under EFH (Section 3.9.1.3).

3.9.1.3 Essential Fish Habitat

Under the Magnuson-Stevens Fishery Conservation and Management Act (see Section 3.9.2, Regulatory Framework, for details), EFH consists of the waters and substrate needed by fish to spawn, breed, feed, or grow to maturity. EFH is designated according to Management Unit Species (MUS), which for Guam includes: coral reef ecosystems, bottomfish, crustaceans, and pelagics. EFH and MUS within Guam waters are described in detail in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.4.2: Essential Fish Habitat, pages 11-18 to 11-38). A subset of EFH, Habitat Areas of Particular Concern (HAPCs), identifies EFH of particular importance to MUS or that is particularly vulnerable to degradation.

The marine ROI and EFH and HAPCs within Guam waters are shown in Figure 3.9.1-1.

Special-Status Species

For the purposes of this SEIS, special-status marine species include those listed under the federal ESA, listed as candidates or proposed for ESA listing, Guam-listed species, and NMFS species of concern (see Section 3.9.2, *Regulatory Framework*). Species descriptions are located in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.1.3: Special-Status Species, pages 11-6 to 11-9 and Volume 9, Appendix G, Chapter 2: Biological Resources, Section 2.2.1).

The ESA defines an *endangered species* as one "in danger of extinction throughout all or a significant portion of its range" (§ 1532). A *threatened species* is one that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (§ 1532). A *candidate species* is a plant or animal species for which the USFWS has sufficient information on file regarding biological vulnerability and threats to support a proposal to list it as endangered or threatened under the ESA but has not yet developed a proposed listing regulation based on the most recent candidate review (USFWS 2013b). NMFS Species of Concern are species where there are some concerns regarding status and threats, but there is not enough information available to indicate that an ESA listing is warranted.

A total of nine special-status species potentially occur within the nearshore waters of Guam: three fish, three sea turtles, and three coral species (Tables 3.9.1-1 and 3.9.1-2). In April 2013, NMFS found that the Indo-West Pacific Distinct Population Segment of the scalloped hammerhead shark be listed as threatened (NMFS 2014a) under the ESA. Information on the distribution of scalloped hammerhead sharks around Guam is limited, but Guam's Outer Apra Harbor has been noted for neonate and juvenile aggregations. The humphead wrasse and bumphead parrotfish are NMFS Species of Concern. NMFS announced in November 2012 that the bumphead parrotfish did not warrant listing under the ESA following a status review (NMFS 2012a). NMFS also found in September 2014 that the humphead wrasse did not warrant listing under the ESA following a status review, but it is virtually extinct from the waters around Guam (NMFS 2014b). In August 2014, NMFS determined that three species of coral known to occur in Guam waters merited listing as threatened under the ESA: *Acropora globiceps, Acropora retusa,* and *Seriatopora aculeata* (NMFS 2014c).

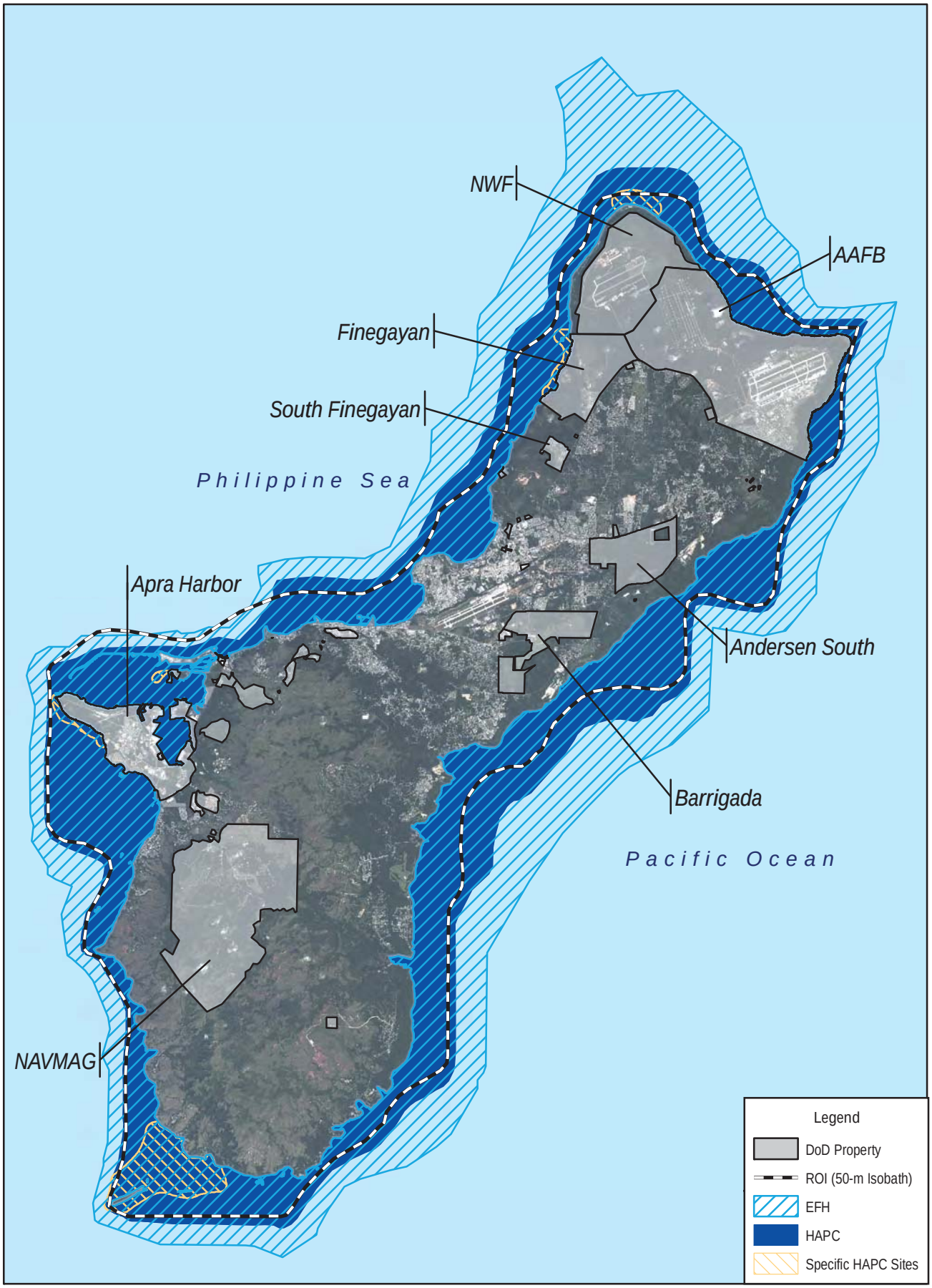


Figure 3.9.1-1
Marine ROI, EFH, and HAPCs within Guam Waters

Sources: WPRFMC 2009; NAVFAC Pacific 2013

Table 3.9.1-1. Special-Status Species within the Guam Marine ROI

Group	*Common Name/Chamorro Name*	*Status**	
		Federal	*Guam*
Fish	Bumphead parrotfish/Atuhong	Species of Concern	-
	Humphead wrasse/Tanguisson	Species of Concern	-
	Scalloped hammerhead shark - Indo-Pacific West Distinct Population Segment	T	-
Reptiles	Green sea turtle/Haggan bed'di	T	T
	Hawksbill sea turtle/Haggan karai	E	E
	Leatherback sea turtle	E	E
Corals	*Acropora globiceps*	T	-
	Acropora retusa	T	-
	Seriatopora aculeata	T	-

Legend: - = not listed; E = Endangered; T = Threatened.
Sources: DON 2005; GDAWR 2006; GovGuam 2009; NMFS 2012a, 2013a, 2013b, 2014a, 2014b, 2014c.

Table 3.9.1-2. Listing Status for Corals Potentially Occurring or Known to Occur within Guam Waters

Coral Species	*Guam*	*Apra Harbor*	*Haputo ERA*	*Orote ERA*	*Guam NWR*	*War in the Pacific NHP*
Acropora globiceps	C		C	L	L	C
Acropora retusa	C	L				
Seriatopora aculeata	C		P	P	P	P

Legend: C = confirmed; L = likely; NHP = National Historic Park; P = possible.
Note: A conservative approach was taken and a published report of a coral species is listed above as "likely" even if that report is unsubstantiated by any other sighting of that species, or if such reporting is difficult to confirm due to physical appearance similarities to other coral species.
Sources: Burdick 2012, 2013; NMFS 2012b, 2014b; Personal communication from V. Brown, Pacific Islands Regional Office Habitat Conservation Division, Guam Field Office, NMFS, to S. Hanser, Marine Biologist, NAVFAC Pacific regarding occurrences of threatened coral species in Guam waters, February 2015.

The threatened green sea turtle and the endangered hawksbill sea turtle are the only ESA- and Guam-listed sea turtles that are anticipated to be in the nearshore marine ROI (<164-foot [50-m] isobath), as identified in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.1.3: Special-Status Species, pages 11-6 to 11-7). The leatherback sea turtle also resides in Guam waters but does not nest on Guam (GDAWR 2006; GovGuam 2009).

3.9.1.4 Marine Conservation Areas

There are currently 10 designated marine conservation areas in Guam: five managed by the Territory of Guam and six managed by the federal government (Table 3.9.1-3 and Figure 3.9.1-2). These areas, officially designated as MPAs, were established to help conserve coral reefs and associated habitat types, and are generally areas of high biodiversity and coral cover. An MPA is defined by EO 13158 as "any area of the marine environment that has been reserved by federal, state, tribal, territorial, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." The level of protection varies among these conservation areas, especially in restrictions on fishing activities, from no-take to uniform or zoned multiple use areas.

Table 3.9.1-3. Summary of Guam Marine Protection Areas

Marine Area	*Level of Protection*	*Management Plan*	*General Description*
Territory of Guam			
Achang Reef Flat Marine Preserve	Marine zoning allocates specific uses to compatible places/times	No	Inner and outer reef flats, mangroves, and seagrass beds.
Pati Point Marine Preserve*	Marine zoning allocates specific uses to compatible places/times	No	High biodiversity and abundance of shallow and deep water coral ecosystems and seagrass beds.
Piti Bomb Holes Marine Preserves	Marine zoning allocates specific uses to compatible places/times	No	Shallow lagoon resembling a barrier reef, most diverse of marine preserves; two unique species of mollusk and one unique species of sea urchin.
Sasa Bay Marine Preserve	No-take	No	Mangrove swamp, Hawksbill Turtle foraging area, habitat for oyster and clam species; patch reefs in deeper waters.
Tumon Bay Marine Preserve	Marine zoning allocates specific uses to compatible places/times	No	2-miles (3.2-km) long and 1,450-foot (442-m) wide limestone reef platform; high recreational use.
Federal			
Guam NWR - Ritidian Unit	Marine zoning with one or more zones prohibiting resource extraction	Yes	Under custody and control of USFWS; submerged lands out to the 30-m isobath; high biodiversity and coral cover.
Haputo ERA	Consistent level of protection with specified allowable activities throughout	Yes	Under DON custody and control; high biodiversity and coral cover.
Orote Peninsula ERA	Consistent level of protection with specified allowable activities throughout	Yes	Under DON custody and control; high turf algal cover.
Pati Point Marine Preserve*	Marine zoning allocates specific uses to compatible places/times	No	High biodiversity and abundance of shallow and deep water coral ecosystems and seagrass beds.
War in the Pacific Natural Historic Park - Agat Unit	Consistent level of protection with specified allowable activities throughout	No	Under NPS custody and control; coral reef parallels the shoreline and extends 1,000-1,500 feet (305-457 m) from the beach; several small islets and two larger islands; high biodiversity.
War in the Pacific Natural Historic Park - Asan Beach Unit	Consistent level of protection with specified allowable activities throughout	No	Under NPS custody and control; extensive reef formations parallel shoreline; one small islet; high biodiversity and coral cover.

Note: A "no-take" area means that any resource extraction or significant destruction is prohibited. The War in the Pacific is managed according to GovGuam Marine Resources Management regulations. *Pati Point Marine Preserve has a dual designation as a federal and Territory of Guam preserve, with submerged lands under DON custody and control.

Source: NOAA 2009.

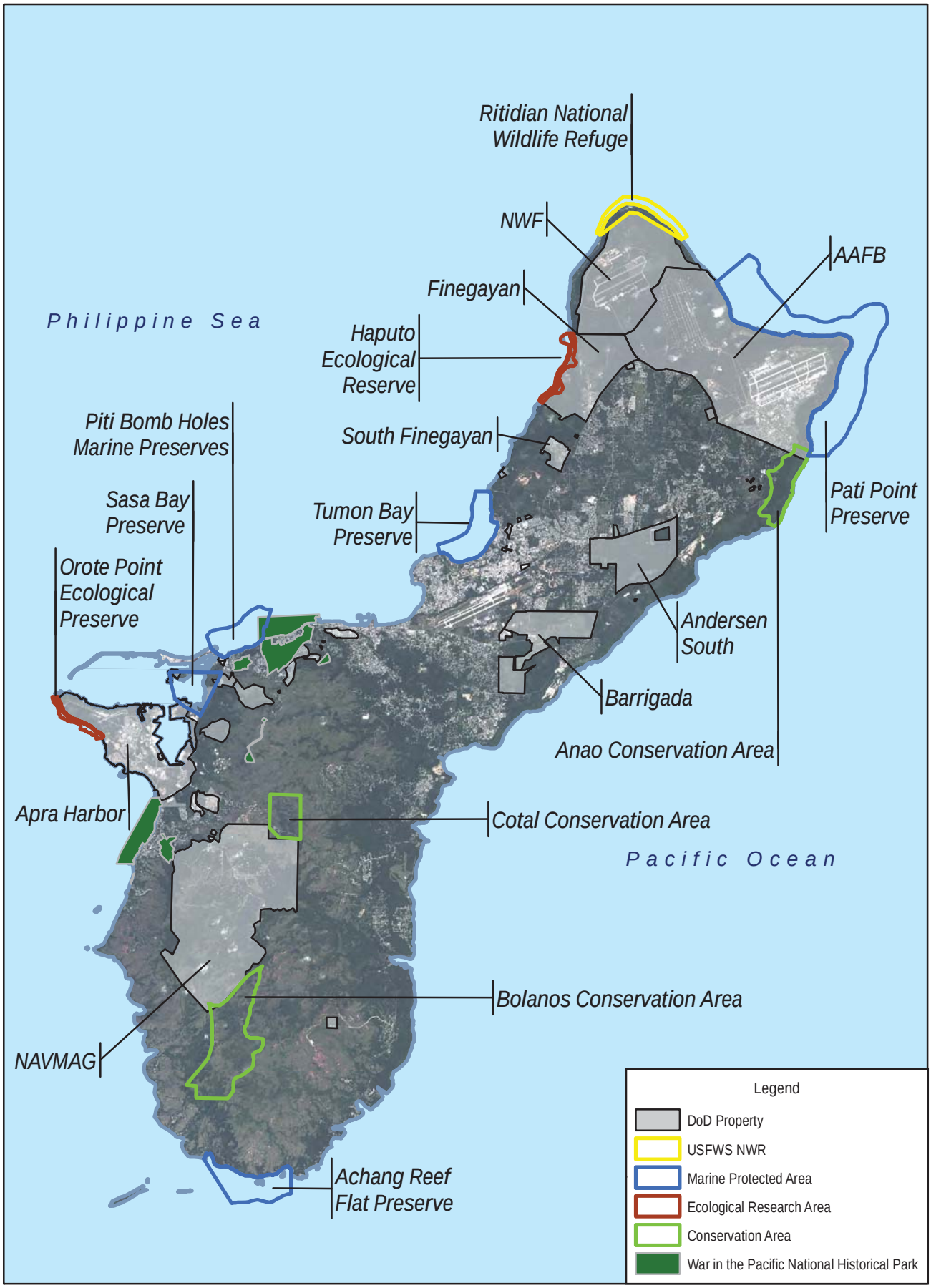


Figure 3.9.1-2
Marine Preserves and Reserves in Guam

Sources: WPRFMC 2009; NAVFAC Pacific 2013

3.9.2 Regulatory Framework

The primary laws and regulations that comprise the regulatory framework for identifying, evaluating, and mitigating impacts from the proposed action are:

- Magnuson-Stevens Fishery Conservation and Management Act
- ESA
- Coastal Zone Management Act
- Section 404(b)(1) of the CWA
- The National Wildlife Refuge System Administration Act (16 USC §§ 668dd-668ee)
- EO 13089, *Coral Reef Protection*
- EO 13112, *Invasive Species*
- EO 13158, *Marine Protected Areas*
- EO 12962, *Recreational Fisheries*, as amended by EO 13474
- Guam's Public Law 24-12 for Marine Preserves

These laws and regulations are summarized below according to the category of marine biological resources to which they apply and are described in more detail in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Sections 11.1: Affected Environment, pages 11-1 to 11-10 and 11.2.1.1: Methodology, pages 11-68 to 11-70).

3.9.2.1 Marine Flora, Invertebrates, Fish, and EFH

Fishery Ecosystem Plans prepared by the Western Pacific Regional Fishery Management Council identify MUS groups and associated EFH. Guam is within the jurisdiction of the Western Pacific Regional Fishery Management Council, which has designated the marine waters around Guam as EFH as listed in Table 3.9.2-1. These EFH designations have not changed since the publication of the 2010 Final EIS.

Table 3.9.2-1. Guam Fishery Ecosystem Plan MUS, EFH, and HAPCs

MUS Group	*EFH (Juveniles and Adults)*	*EFH (Eggs and Larvae)*	*HAPC*
Coral Reef Ecosystems	Water column and benthic substrate to a depth of 328 feet (100 m)	Water column and benthic substrate to a depth of 328 feet (100 m)	All marine protected areas identified in a Fishery Ecosystem Plan, all Pacific Remote Islands Areas, many specific areas of coral reef habitat
Bottomfish	Bottom habitat and water column to a depth of 1,312 feet (400 m)	Water column to a depth of 1,312 feet (400 m)	All escarpments and slopes at a depth of 130 - 920 feet (40-280 m)
Crustaceans	Bottom habitat from shoreline to a depth of 328 feet (100 m)	Water column to a depth of 490 feet (150 m)	None
Pelagics	Water column to a depth of 3,280 feet (1,000 m)	Water column to a depth of 656 feet (200 m)	Water column above seamounts and banks to a depth of 3,280 feet (1,000 m)

Note: All areas are bounded by the shoreline and the outer boundary of the Exclusive Economic Zone (200 nautical miles [370-km] from the coast), unless otherwise indicated.
Source: Western Pacific Regional Fishery Management Council 2009.

EO 13089, *Coral Reef Protection*, requires all federal agencies whose actions may affect U.S. coral reef ecosystems to: (1) identify such actions, (2) utilize their programs and authorities to protect and enhance the condition of coral reef ecosystems, and (3) to the extent permitted by law, ensure actions authorized, funded, or carried out by them would not degrade the conditions of such ecosystems. Should their actions

negatively impact such ecosystems, federal agencies are required to provide for "implementation of measures needed to research, monitor, manage, and restore affected ecosystems including, but not limited to, measures reducing impacts from pollution, sedimentation, and fishing."

EO 13112, *Invasive Species*, establishes responsibilities and initiatives of the federal government for controlling non-native species.

The Coastal Zone Management Act establishes a federal-state partnership to provide for the comprehensive management of coastal resources. Coastal states and territories develop management programs based on enforceable policies and mechanisms to balance resource protection and coastal development needs. Actions implemented on federal lands must ensure consistency with these plans and programs to the maximum extent practicable. Under the Guam Coastal Management Program, federal activities must be consistent with the resource policy for marine Fragile Areas and Living Marine Resources. The Fragile Area policy generally states that development must be regulated to protect marine biological resources such as wildlife habitats, pristine marine communities, mangrove stands and other wetlands, and coral reefs. The Living Marine Resources policy requires that fish shall be protected from overharvesting and prohibits the taking of corals, sea turtles, and marine mammals.

Finally, the Guidelines of CWA Section 404(b)(1) were developed by the USEPA and the Army to assist in determining the type and level of mitigation necessary to restore and maintain the chemical, physical, and biological integrity of U.S. waters, including special aquatic sites. Special aquatic sites are identified in 40 CFR 230, Subpart E as sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle pool complexes. The USACE is responsible for implementing the Section 404 permitting program and is prohibited from issuing a permit for any discharge of dredged or fill material in waters of the U.S. that does not comply with the Guidelines of the CWA.

3.9.2.2 Special-Status Species

Several regulations apply to special-status species, as defined in this SEIS to include ESA-listed, -candidate, and -proposed species, as well as species of concern. The ESA offers protection to species that have been listed as endangered, meaning species in danger of extinction throughout all or a significant portion of their range, or threatened, meaning species likely to become endangered in the foreseeable future (7 USC § 136, 16 USC § 1531 *et seq*.), and is described in detail in Section 3.8.2.

Guam-Listed Species

Guam-listed species are those designated by legislative authority in the Territory of Guam as species that are endangered or threatened under the Guam ESA or are listed as SOGCN in the CWCS (GDAWR 2006). The CWCS identifies conservation actions and monitoring efforts led by GDAWR to manage Guam's natural resources, especially in reference to Guam-listed threatened and endangered species and SOGCN. For marine species, Guam-listed species are all also ESA-listed species, and will therefore be discussed under the general heading of special-status species.

3.9.2.3 Marine Conservation Areas

MPAs also contribute to the regulatory framework in that they have established specific, legally enforceable restrictions on activities within such areas. Guam's Public Law 24-12 created five marine preserves and limited fishing activities within them. The local MPA statute is implemented under Fishing Regulations, 9 GAR, Division 2, Chapter 12, along with other general and specific fishing requirements that are applicable within federal submerged lands. At the federal level, five MPAs occur within Guam waters (or six, given Pati Point Marine Preserve's dual designation as a federal and Territory of Guam

preserve). Activities within these areas are managed in accordance with EO 13158, *Marine Protected Areas*, and EO 12962, *Recreational Fisheries*, as amended by EO 13474.

The National Wildlife Refuge System Administration Act (16 USC §§ 668dd-668ee) establishes a unifying mission for the NWR System, a process for determining compatible uses of refuges, and a requirement for preparing comprehensive conservation plans. The Act states that the mission of the Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans. The Act authorizes the Secretary of Interior, under such regulations as he/she may prescribe, to "permit the use of any area within the System for any purpose, including but not limited to hunting, fishing, public recreation and accommodations, and access whenever he/she determines that such uses are compatible with the major purposes for which such areas were established." The Guam NWR is part of the System, and any new uses of the Refuge associated with the proposed action must be compatible with the mission of the System and the purposes of the Refuge. The Marine Biological Resources sections in this SEIS describe the potential impacts to marine areas of the Guam NWR.

The purpose of EO 13158 is to, consistent with domestic and international law: (a) strengthen the management, protection, and conservation of existing marine protected areas and establish new or expanded MPAs; (b) develop a scientifically based, comprehensive national system of MPAs representing diverse U.S. marine ecosystems, and the Nation's natural and cultural resources; and (c) avoid causing harm to MPAs through federally conducted, approved, or funded activities.

EO 12962, as amended by EO 13474, ensures that "recreational fishing shall be managed as a sustainable activity in national wildlife refuges, national parks, national monuments, national marine sanctuaries, marine protected areas, or any other relevant conservation or management areas or activities under any federal authority, consistent with applicable law."

The regulations and marine resource protections described above form the framework for the approach to analysis for marine resources.

3.9.3 Approach to Analysis

3.9.3.1 Methodology

The methodology for identifying, evaluating, and mitigating impacts to marine biological resources is based on the federal laws and regulations described in Section 3.9.2, Regulatory Framework and is more fully explained in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Sections 11.2.1.1: Methodology, pages 11-68 to 11-71 and 11.2.1.2: Determination of Significance, pages 11-71 to 11-73).

Key sources of information for this section include the 2010 Final EIS, the JRM INRMP (JRM 2013), the Guam CWCS (GDAWR 2006), recent analyses of threats to marine resources in the Guam ROI, and marine resource surveys not available during the preparation of the 2010 Final EIS. This includes the recently revised NOAA Pacific Islands Fisheries Science Center Coral Reef Ecosystem Monitoring Report of the Mariana Archipelago: 2003-2007, new survey data from NOAA Pacific Islands Fisheries Science Center Coral Reef Ecosystem Division underwater visual surveys in Guam from April to June 2011, and new information regarding the ESA listing of four coral species as threatened that occur around Guam and the ESA listing of the Indo-West Pacific Distinct Population Segment of the scalloped hammerhead shark as threatened.

Potential impacts to marine biological resources include direct, indirect, and cumulative impacts of the proposed action during construction and operation phases. Impacts may be either temporary (reversible) or permanent (irreversible). NEPA defines direct impacts as those caused by the action and that occur at the same time and place (e.g., the "taking" of special-status species, increased noise, decreased water quality, and lighting impacts resulting from construction or operation activities). Indirect impacts are caused by the action and are later in time or farther removed in distance but are reasonably foreseeable (e.g., increased likelihood of additional recreational use of marine resources near the newly constructed cantonment, effects from changes in population density or growth rate). Impacts to EFH, specifically, may be direct, indirect, site-specific, or habitat wide, but per the Magnuson-Stevens Fishery Conservation and Management Act, are evaluated in terms of "adverse" impacts, meaning any impact that reduces the quality and/or quantity of EFH.

The implementation of appropriate resource agency (USFWS/NOAA-NMFS) BMPs, construction and industrial permit BMPs, LID features in accordance with the DoD UFC LID (UFC 3-210-10) and Section 438 of the EISA, USACE permit conditions, and general maritime measures in place by the military and U.S. Coast Guard is assumed for each resource and anticipated to reduce any construction- and operation-related impacts to marine biological resources. Applicable BMPs are more fully explained in Chapter 2 of this SEIS and in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.2.1.1: Methodology, pages 11-70 to 11-71 and Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, pages 2-1 to 2-63).

General principles used to evaluate impacts are:

- The extent, if any, that the action would diminish suitable habitat for a special-status species or permanently lessen designated EFH for the sustainment of managed fisheries.
- The extent, if any, that the action would disrupt the normal behavior patterns or habitat of a federally listed species and substantially impede the DON's ability to either avoid jeopardy or conserve and recover the species.
- The extent, if any, that the action would diminish population sizes or distribution of special-status species or designated EFH.
- The extent, if any, that the action would be likely to jeopardize the continued existence of any special-status species or result in the destruction or adverse modification of habitat of such species of designated EFH.
- The extent, if any, that the action would permanently lessen physical and ecological habitat qualities that special-status species depend upon, and which partly determines the species' prospects for conservation and recovery.
- The extent, if any, that the action would result in substantial loss or degradation of habitat or ecosystem functions (natural features and processes) essential to the persistence of native marine flora or fauna populations.
- The extent, if any, that the action would be inconsistent with the goals of the JRM INRMP.

3.9.3.2 Impact Assessment Criteria

Assessment of impacts to marine flora and fauna, special-status and Guam-listed species, or designated MPAs is performed using the guidelines in the previous section. As used in NEPA, impact analysis requires consideration of both context and intensity. Context requires consideration of society as a whole, the affected region, affected interests, and the locality, including both short-term and long-term effects. Intensity refers to the severity of the impact. Specific criteria are discussed below.

In general, the following factors are taken into consideration when determining impacts to marine flora and fauna:

- Intensity of the impact at the specific site being affected.
- Spatial extent of the area to be impacted in relation to the availability of the specific habitat type to be impacted.
- Sensitivity and vulnerability of the habitat to be affected.
- Habitat functions that may be altered by the impact (e.g., shelter from predators).
- Timing of the impact relative to when the species or life stage needs the habitat.

Marine Flora and Invertebrates

Impacts to marine resource habitat (estuary, mangroves, seagrass, or coral reef) or water quality are evaluated according to whether they would be impacted by the proposed action to the point of reducing the quality or quantity of such marine resource habitat.

Fish

Impacts to fish are evaluated according to whether the proposed action would result in more than minimal changes in population sizes or distributions of regionally important native fish species.

Essential Fish Habitat

Determinations of impacts for EFH assessments fall under one of two categories: (1) no adverse effect on EFH or (2) may adversely affect EFH (NMFS 2004). Potential impacts that would be permanent require further consultation than those that would be temporary. Temporary or minimal impacts are not considered to adversely affect EFH, with temporary impacts defined as those that are limited in duration and allow the EFH to recover without measurable impact (50 CFR 600.815(a)(2)(ii); NMFS 2002).

Special-Status Species

Impacts are evaluated if special-status species are present in the project area and if the proposed action is likely to result in harassment or harm of an individual or population. Impacts also include the disturbance of ESA-listed species due to noise, lighting, or human activity. If unoccupied but recognized suitable habitat would be affected by operational noise, lighting, or human activity, impacts are evaluated, unless the area affected is considered minor in relation to the remaining quantity and quality of habitat available to a species.

For ESA-listed species, federal agencies are required to ensure that their actions do not jeopardize the continued existence of an endangered or threatened species or its critical habitat (note: there is no critical habitat for marine species in Guam), meaning the reduced reproduction, numbers, or distribution, which would reduce appreciably the likelihood of the survival and recovery of that species. Analyses of potential impacts are based on a review of the proposed action and the available current and historical distributional data for each species.

Marine Conservation Areas

Impacts to MPAs are evaluated for any action that would preclude ongoing management activities to ensure sustainable activities in the MPAs. The assessment of such impacts would consider the possibility that while the proposed action may cause some modifications to ongoing management activities, it may not necessarily prevent them from occurring and meeting their objectives (i.e., management-related personnel may need to coordinate their activities with military personnel to ensure their safety during scheduled military training exercises).

3.9.3.3 Public Scoping Issues

The scoping comments/concerns regarding marine biological resources are summarized as follows:

- Potential impacts to endangered species (including nesting habitats), species of concern, and federal trust species such as corals.
- Potential impacts from military expansion activities resulting in a larger population using marine resources for recreational purposes, and thereby causing a negative impact on those marine resources.
- Potential impacts of construction causing decreased water quality (secondary impact for marine resources), resulting in increased overall stress to corals with lower tolerance for turbid waters.
- Potential impacts from construction activities (and long-term stormwater runoff) that could result in increased sedimentation, nutrient loading, and contamination (particularly from MCs) of marine resources.
- With the high likelihood of many of the coral species being considered for ESA listing occurring in the Haputo ERA, it is recommended that a Management Plan be prepared to address potential impacts to marine resources.
- Impacts to culturally significant marine-related areas for subsistence fishing and beliefs due to access limitation around proposed LFTRC alternative locations.
- Update existing conditions description of Fena Reservoir and analyze potential impacts due to contamination from MCs, lead, sediment, and other pollutants (this is addressed in this document under the Water Resources sections).
- Access to the Guam NWR - Ritidian Unit would be limited or not allowed due to the LFTRC, thereby impacting marine education and conservation activities.

3.10 CULTURAL RESOURCES

3.10.1 Definition

The term *cultural resource* applies broadly to a variety of resources subject to consideration under NEPA, the National Historic Preservation Act (NHPA), the Archeological Resources Protection Act (ARPA), and similar laws. Included are *historic properties* as defined under NHPA, to include districts, sites, buildings, structures, or objects that are listed or eligible for listing in the National Register of Historic Places (NRHP). Under NEPA, the consideration of cultural resource issues may include properties that do not meet NRHP criteria, such as cemeteries, places of special cultural significance, plants or geological materials of importance to a culture, archaeological sites not eligible for the NRHP, and archaeological collections (CEQ and Advisory Council on Historic Preservation [ACHP] 2013).

Historic properties under NHPA may include Pre-Contact (before European contact) and Post-Contact archaeological resources, built properties, and traditional cultural properties (TCPs). Archaeological resources are areas or locations (sites) where human activity measurably altered the earth or left deposits of physical remains. Architectural resources, or built historic properties, include buildings and other structural types that reflect significant historic, engineering, or aesthetic values. TCPs are historic properties, usually sites or landscapes with a defined overlay of traditional cultural significance derived from associations with cultural practices and beliefs of a living community that are rooted in its history, and are important in maintaining the continuing cultural identity of the community.

3.10.2 Regulatory Framework

Statutory and regulatory requirements for cultural resources arise from NEPA, NHPA, and other statutes and EOs, including the Abandoned Shipwreck Act (1987); Sunken Military Craft Act (2004); ARPA of 1979; EO No. 13287, Preserve America (2003); and the Coastal Zone Management Act (16 USC §§ 1451-1464). Additional regulations include Curation of Federally-Owned and Administered Archeological Collections (36 CFR Part 79); Criteria for Evaluation (36 CFR § 60.4); and Protection of Historic Properties (36 CFR Part 800).

The Sunken Military Craft Act protects sunken U.S. military vessels and aircraft and the remains of their crews from unauthorized disturbance. ARPA establishes permitting procedures for conducting archaeological fieldwork on public lands and fines and penalties for unauthorized excavation. It also calls for the preservation of objects and associated records and prohibits public disclosure of information on the locations of archaeological resources if they could be damaged. EO 13287 promotes the long-term preservation and use of historic properties. The Coastal Zone Management Act establishes a federal-state partnership to provide for the comprehensive management of coastal resources, which may include coastal cultural resources in Guam's MPA. Federal actions must ensure consistency with Fragile Area Policy to the maximum extent practicable. Regulation 36 CFR § 60.4 establishes the criteria to evaluate properties for listing in the NRHP and 36 CFR Part 800 describes the process for the identification and assessment of adverse effects to historic properties (the Section 106 process).

Most commonly, NHPA is the predominant driver of cultural resource identification and protection. The criteria of eligibility for listing in the NRHP state: "The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

- are associated with events that have made a significant contribution to the broad pattern of history, or
- are associated with the lives of persons significant in the past, or
- embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic value or represent a significant and distinguishable entity whose components may lack individual distinction, or
- have yielded, or may be likely to yield information important in prehistory or history." (NPS 2002)

Properties that either meet or potentially meet these criteria are subject to protection under Section 106 of the NHPA, which requires federal agencies to take into account the effect of any undertaking upon NRHP listed or eligible resources, share information about undertakings with the potential to affect historic properties, and to afford the ACHP an opportunity to comment prior to initiating the proposed undertaking. Federal regulation 36 CFR § 800, "Protection of Historic Properties," defines specific procedures for federal agencies to follow in complying with Section 106 of NHPA.

Under 36 CFR § 800.14, federal agencies may develop program alternatives to implement Section 106. Program alternatives relevant to this analysis include program comments and programmatic agreements (PAs). Program comments are issued by the ACHP to allow an agency to implement alternative Section 106 compliance for a category of undertakings in lieu of conducting a separate review for each individual undertaking under the regular processes codified under 36 CFR §§ 800.4-6. For example, the *Program Comment for Capehart and Wherry Military Family Housing* resolves Section 106 requirements for a

category of undertakings affecting specific family housing property types and landscape features dating from 1949-1962 (ACHP 2004). The *Program Comment for Cold War Era Unaccompanied Personnel Housing* resolves Section 106 requirements for undertakings affecting unaccompanied personnel housing types, such as barracks, and support facilities dating from 1946-1974 (ACHP 2006). Under these program comments, Section 106 responsibilities are resolved for actions such as maintenance, repair, layaway, mothballing, privatization and transfer out of federal agency ownership, substantial alteration through renovation, demolition, and demolition and replacement.

A PA establishes a Section 106 program alternative to govern the implementation of programs or complex project situations, particularly when potential effects to historic properties are not fully known in advance (36 CFR § 800.14(b)). The relocation action addressed in the 2010 ROD was just such a situation, given that numerous projects making up the relocation had not been defined enough to fully evaluate effects to historic properties, and the a decision on the LFTRC was deferred. In order to address responsibilities under Section 106 and related requirements for the relocation action, the DON consulted with the public, key agencies, and non-governmental organizations to develop a PA. These consultation resulted in execution of the 2011 *Programmatic Agreement among the Department of Defense, the Advisory Council on Historic Preservation, the Guam Preservation Officer, and the Commonwealth of the Northern Mariana Islands State Historic Preservation Officer Regarding the Military Relocation to the Islands of Guam and Tinian* (2011 PA). In order to ensure adequate consideration of historic preservation requirements for the relocation action, the 2011 PA was developed consistent with 36 CFR § 800.14(b)(3) as a program alternative to satisfy Section 106 responsibilities, with explicit flexibility to address changes in the undertaking:

> WHEREAS, should there be changes to the projects included within the Undertaking, or new actions or projects proposed that support the Undertaking, that have potential effects on historic properties that have not been fully analyzed, DoD will conduct supplementary consultations pursuant to the terms of this PA; (2011 PA, p.2).

In developing this SEIS, the DON discussed with the ACHP, State Historic Preservation Officer (SHPO), other parties to the PA, and the public the applicability of the 2011 PA to the revised relocation action. The 2011 PA governs processes for considering the views of the public and the parties to the 2011 PA, including the SHPO, the ACHP, NPS, and other interested parties, as projects under the relocation action are defined, in order to confirm the identification, evaluation, and mitigation measures when historic properties may be adversely affected.

Consistent with federal law, certain types of information related to cultural resources are protected from general distribution. NHPA and ARPA each contain confidentiality restrictions to prevent inappropriate general releases of locational data for archaeological sites and TCPs under custody and control of the federal government. Consistent with these provisions, this SEIS does not contain detailed locational descriptions or figures showing the specific locations of archaeological sites or TCPs.

3.10.3 Approach to Analysis

3.10.3.1 Methodology

The methodology and process for identifying and evaluating historic properties are established under authority of the NHPA. Section 106 regulations direct federal agencies to identify historic properties when proposing undertakings of the type that could affect them (36 CFR § 800.4(b)(1)). In meeting the "reasonable and good faith identification" requirements under Section 106, agencies are to take into account past planning, research and studies; the magnitude and nature of the undertaking and the degree of federal involvement; the nature and extent of potential effects on historic properties; and the likely

nature and location of historic properties within areas that may be affected (ACHP 2007). Additionally, the NPS has published the Secretary of the Interior's standards and guidelines for the identification of historic properties (48 FR 44716).

The methodology for considering cultural resources under NEPA is similar to the process under the NHPA. The CEQ regulations require agencies to describe the environment, including cultural resources, likely to be affected by the proposed action and alternatives, and to discuss and consider the environmental effects of the proposed action and alternatives so decision makers and the public may compare the consequences associated with alternate courses of action. Data and analysis vary depending on the importance of the impact, and the description should be no longer than necessary to understand the effects of the alternatives, with less important material summarized, consolidated, or referenced. As discussed above, "cultural resources" covers a wider range of resources than historic properties and may include sites of cultural importance that are not eligible for listing in the NRHP. Appropriate consideration of these types of cultural resources may occur through Section 106 consultation, the public involvement process, or the involvement of interested historical and cultural groups.

Consistent with these requirements and guidelines, the DON used a combination of methods to identify historic properties, identify other cultural resources, and analyze potential impacts for each alternative. The DON reviewed previous studies to identify existing information on historic properties within the potential impacted areas and identified the locations that would require additional study, whether through in-fill pedestrian survey (a survey of previously unsurveyed areas), subsurface testing, or literature review and predictive modeling. The DON subsequently prepared two work plans summarizing the proposed in-fill work and identifying areas requiring additional study based on notional designs for potential impact areas available in November 2012. The two work plans were submitted to the Guam Historic Resources Division for review and comment, and are titled *Archaeological Surveys and Cultural Resource Studies, Live-Fire Training Range Complex Naval Munitions Site and Route 15 Alternatives, Territory of Guam* (Dixon *et al.* 2013a) and *Archaeological Surveys and Cultural Resource Studies, Live-Fire Training Range Complex NCTS Finegayan and Northwest Field Alternatives and Main Cantonment Alternatives, Territory of Guam* (Dixon *et al.* 2013b). In addition to detailing the essential components for carrying out the in-fill survey tasks, the work plans presented the approach, methodology, personnel, and schedule for accomplishing the studies. The work plans also included historical backgrounds, summaries of previous archaeological research, and examinations of historic maps of the potential impacted areas. The DON followed the procedures from the previously submitted work plans in conducting subsequent surveys.

The in-fill study areas were separated into two major categories: areas where proposed actions could directly affect cultural resources and those where proposed actions could indirectly affect cultural resources. The differentiation was made consistent with the NHPA definitions of direct and indirect effects. For purposes of this analysis, these categories are referred to as the "Potential Direct Impacted Area" (PDIA) and the "Potential Indirect Impacted Area" (PIIA), defined comparably to the "Area of Potential Effects" under NHPA. PDIAs are those areas proposed for range, road, or cantonment construction, and utility (electric, water, communication) improvements. PIIAs are those areas proposed for SDZs and adjacent areas within the 65 dB noise contour, where no construction is proposed.

Based on the work plans, the DON conducted intensive surveys for all of the PDIAs that had not been previously surveyed, referred to in this SEIS as in-fill survey areas. For these areas, pedestrian surveys were based on survey transects spaced no more than 16.4 feet (5 m) apart. Site recordation in these areas followed standard procedures. When a site was identified in a PDIA, it was recorded in terms of the horizontal and vertical dimensions, number and type of associated features, morphology, function,

presence of surface artifacts, cultural affiliation or occupation period, vegetation, and ground surface visibility. The field teams recorded and prepared detailed maps, site descriptions, photo-documented all archaeological resources identified within the in-fill survey areas and collected sufficient data to evaluate these sites consistent with 36 CFR § 60.4. In-fill surveys in PDIAs included subsurface testing via the placement of either shovel test pits or controlled test units for the purpose of determining presence or absence of intact subsurface cultural deposits in areas not previously subject to development. Architectural properties in the in-fill survey areas within PDIAs were recorded through detailed descriptions of construction techniques, existing conditions, character-defining features, and alterations. Each property was photographed and evaluated using the NRHP criteria, and Guam Historic Properties Inventory (GHPI) forms were completed for each site, building, or other property type.

For the PIIAs, the DON conducted reconnaissance inventories, which included literature reviews supplemented with pedestrian surveys. These surveys were conducted with survey transects spaced at 32.8 foot (10 m) intervals. Archaeological site recordation included sketch maps. Also, one global positioning system point was recorded at the center of each site. No eligibility determinations were made for the sites identified, and GHPI data forms were not completed. PIIAs were not subject to subsurface testing. Architectural properties within PIIAs were described and photographed. Buildings and structures within the PIIAs were not evaluated for eligibility for listing in the NRHP.

In both PDIAs and PIIAs, the beginning and ending transect coordinates were recorded with a sub-meter accuracy, survey-grade Trimble GeoXH GeoExplorer 2008 Series Global Positioning System unit to ensure the survey area was completely covered. Transect orientation was determined by terrain and access. Some areas could not be surveyed for safety reasons, such as prohibited access or areas too steep to safely navigate on foot, or because of inability to see the ground due to standing water. Terrain in either area that could not be surveyed for safety reasons was marked on a map and explained in the results section of respective chapters in the cultural resource technical reports.

Once in-fill surveys were completed, all available information regarding cultural resources was synthesized to facilitate an analysis of potential impacts for each alternative. The results of the in-fill surveys for the PDIAs and PIIAs were summarized in reports detailing a review of previous surveys, methods, site and structure descriptions, NRHP evaluations (for PDIAs), and possible effects from the proposed action (Dixon *et al.* 2015a, 2015b).

Proposed utility improvement corridors were analyzed through an in-depth literature review of previous studies and primary source archival/historic documents to establish a chronology of Pre-Contact and Post-Contact activity and land use patterns, to support assessments of potential sensitivity for future reviews. Draft reports, which included summaries of the results of in-fill surveys and the literature review of utility improvement corridors, were submitted to Guam SHPO for review.

For properties dated after World War II (WWII), the Navy Cold War Context provided a primary analytical base for assessing the potential significance of properties from 1946 to 1991 (Aaron 2011). The Navy Cold War Context supported consideration of NRHP eligibility and for identifying properties of potentially exceptional significance that are less than 50 years old (Criteria Consideration G).

The 2011 PA includes procedures for consulting on the identification of historic properties as specific projects are developed. Data gathered during the in-fill studies conducted for this SEIS and information available in other previous cultural resource investigations will contribute to the review procedures in the 2011 PA. Under the 2011 PA, the DoD conducts annual reviews of proposed projects for the purpose of seeking information from the Signatories, Invited Signatories, Concurring Parties and the public regarding historic properties in project areas as part of the process for identifying historic properties and

completing determinations of eligibility. Individual project reviews are conducted via a PA Memo process for the purpose of soliciting additional comments regarding the DoD's determination of effect. If adverse effects are identified, DoD solicits input on its plan for resolving the adverse effects. When new information is received regarding the potential presence of historic properties, the 2011 PA outlines a process for consideration of supplemental identification measures. The 2011 PA also includes a detailed review process for avoiding, minimizing and mitigating adverse effects specific to the construction and operation of an LFTRC on Guam, including preparation of a TRRA and a Range Mitigation Plan (RMP). Once the identification, evaluation, and determination of effect processes summarized above have been completed, the 2011 PA outlines general and project or area-specific mitigation measures. Mitigation is generally defined as taking specific steps designed to lessen the adverse effects of a DoD action on a historic property. Mitigation for adverse effects to archaeological sites includes preparation of a mitigation plan, which is submitted to the SHPO for review. All mitigation work is to be documented in draft reports submitted to SHPO for review prior to being finalized.

3.10.3.2 Impact Assessment Criteria

Under NEPA, the analysis of the significance of an impact to a cultural resource is driven by the context and intensity of impacts associated with the action. Standard analysis identifies direct, indirect, and cumulative impacts. Direct impacts "are caused by the action and occur at the same time and place." Indirect impacts "are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." Indirect impacts may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR § 1508.8). A cumulative impact is "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions…" (CEQ 1997). Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The 2011 PA includes procedures to ensure full consideration of cumulative impacts to cultural resources.

Under NHPA and its associated regulations (36 CFR 800), an adverse effect may occur when an undertaking has the potential to affect the characteristics of a historic property qualifying it for listing in the NRHP. Adverse effects may be direct, indirect, or cumulative. Direct adverse effects result from the direct loss of character-defining features and/or aspects of integrity. Similar to NEPA, they usually occur at the same time or place. Indirect adverse effects, under NHPA, such as auditory or visual effects, are not necessarily later in time or farther removed in distance as defined under NEPA. They may result from alterations in the setting, feeling, or association of historic properties, or in the case of TCPs, reduced access. Cumulative adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time or be farther removed in distance.

The discussion of potential direct, indirect, and cumulative effects to historic properties in Chapters 4, 5, 6, and 8 conforms to NHPA. In contrast, the discussion of cultural resources that are not historic properties follows NEPA. Ultimately, the conclusions related to the potential impacts of each alternative (for historic properties and cultural resources that are not historic properties) are based upon NEPA terminology. This is similar to the approach used in the 2010 Final EIS and follows the procedures for the consideration of effects and impacts outlined in the 2011 PA.

Additionally, the existing environment has been delineated as "PDIAs" and "PIIAs" as defined under the NHPA definition of direct and indirect effects and explained above. These areas do not delineate or confine impacts under the NEPA definition of indirect or direct impacts.

3.10.3.3 Public Scoping Issues

The analysis in this SEIS focuses on possible impacts to cultural resources—archaeological resources, architectural properties, TCPs, and resources of cultural importance—that could be impacted or affected by the proposal. As part of the analysis, concerns relating to cultural resources that were mentioned by the public, including regulatory stakeholders, during scoping meetings are addressed in Chapters 4 and 5 of this SEIS. These include:

- Impacts to Pågat, Pågat Cave, and Marbo Cave sites.
- Impacts to NWF cultural sites.
- Impacts to cultural sites in general.
- Loss of access to traditional or medicinal plants.

3.11 VISUAL RESOURCES

3.11.1 Definition

This section describes the applicable existing visual conditions and resources on Guam by geographical area. While the focus is on the visual resources on those lands being considered under the proposed action, it also includes areas within the general ROI. The ROI includes not only the areas proposed for development, but also areas in the vicinity of the proposed development. Visual resources include scenic areas, vistas or thoroughfares, and locations that provide natural-appearing or aesthetically pleasing places or views. This includes natural views such as shorelines, seascapes, cliffs, and man-made views such as unique buildings, landscaping, parks, and other types of cultural features.

In addition to vistas and scenic overlooks, visual resources are also recognized as views and vistas that people are accustomed to seeing and often take for granted as a general part of the landscape.

Visual resources are an important part of the quality and sensory experience of an area. Users often encounter an area first and foremost through a visual interaction, or their "view" of a place. Views are often described in terms of foreground, middle-ground, and background, depending on the site. For analysis purposes, visual resources include the following:

- Dominant landscape features (e.g., a tall water tower in a landscape otherwise consisting of low vegetation and one or two story buildings).
- Diversity (e.g., rows of crops adjacent to an urban area with the mountains as a backdrop).
- Elements of line, color, form, and texture.
- Distinctive visual edges (e.g., a housing tract adjacent to a forested area).

3.11.2 Regulatory Framework

Regulations pertaining to the protection and preservation of visual resources vary by location and jurisdiction. The Coastal Zone Management Act's consistency determination process requires compliance with Guam's enforceable policy regarding effects to scenic coastal resources. The policy encourages the preservation and enhancement of scenic resources through compliance with sign, litter, zoning, subdivision, building, and related land-use laws. The policy also requires, to the maximum extent practical, that the project be designed to minimize degradation of significant views from scenic overlooks, highways, and trails. As a federal project, the proposed action may be subject to various provisions of the National Wild and Scenic Rivers Act; National Trail Systems Act; National Historic Landmarks Program;

National Historic Preservation Act; Forest Management Act; and Federal Land Policy and Management Act. As part of a larger project involving the FHWA, various visual preservation provisions may be applicable pertaining to visual corridors along public roadways.

Updated and released on May 15, 2012, UFC 2-100-01 (Installation Master Planning) provides planning guidelines, including aesthetics, for military installations. Pertinent parts of UFC 2-100-01 would be applied, where appropriate, to provide a framework for considering visual impacts of base development projects. In addition, the Haputo ERA Management Plan requires a no construction buffer of 100 feet (30.5 m) from the ERA boundary. Beyond the no construction buffer zone, there would be a 200 foot (61 m) buffer zone where landscaping, fencing, and mowing would be allowed. There would also be an additional buffer of approximately 440 feet (134 m) from the cliffline to the Haputo Bay shoreline (total of 0.1 mile [0.2 km]).

3.11.3 Approach to Analysis

3.11.3.1 Methodology

Information on visual resources was gathered through review of previous on-site visits, background research, and the review of stakeholder and public meeting notes as part of the 2010 Final EIS, as well as the scoping meetings held as part of this SEIS. The analysis of potential impacts to visual resources is based on the long-term operational effects (i.e., after construction has occurred and all buildings, facilities, and structures are in place). Construction-related activities associated with the development of the facilities would be relatively minimal and temporary in their impacts (i.e., earth-moving equipment clearing vegetation, altering terrain, constructing facilities).

3.11.3.2 Impact Assessment Criteria

Consistent with the 2010 Final EIS to which this is a supplement, the same determinations of significance are used in this SEIS (Volume 2, Chapter 13: Visual Resources, Section 13.2.1.1: Methodology, page 13-62). The proposed action and alternatives would cause a significant impact to visual resources if they:

- Would substantially alter the views or scenic quality associated with particularly significant and/or publicly recognized vistas, view sheds, overlooks, or features, including views from the ocean.
- Would substantially change the light, glare, or shadows within a given area.
- Would substantially affect sensitive receptors, i.e., viewers with particular sensitivity (or intolerance) to a changed view (e.g., a hillside neighborhood with views of a relatively undisturbed, naturally-appearing landscape).

3.11.3.3 Public Scoping Issues

The scoping comments/concerns regarding visual resources are summarized as follows:

- Preservation of the scenic resources of the National Natural Landmarks, the War in the Pacific National Historic Park, and the aesthetic quality of Guam overall.
- Potential degradation of the aesthetic quality of the coastline and scenic views of the coast.

3.12 GROUND TRANSPORTATION

3.12.1 Definition

The definition of ground transportation resources in this SEIS is the same as that described in the 2010 Final EIS (Volume 6, Chapter 4: Roadways, Section 4.1.1: Definition of Resource, page 4-1).

3.12.1.1 On-Base Roadways

On-base roadways refers to transportation features that support vehicular, transit, pedestrian, and bicycle traffic within the DoD military bases and training ranges. Roadways internal to military sites are discussed in Chapter 4 and Chapter 5 in this SEIS. The potential effects on roadways within the bases as a result of the increased number of vehicle trips and vehicle movements associated with the proposed relocation of Marine Corps personnel to Guam are assessed and presented.

3.12.1.2 Off-Base Roadways

The study area for this transportation analysis consists of 57 intersections and 33 roadways located throughout the island of Guam. The study roadways are numbered highways in Guam that are eligible for Federal-Aid Highway funding. The study roadways cover approximately 470 lane miles (756 km) and represent the primary transportation corridors on the island of Guam. Off-base roadways refer to transportation roadway features that support vehicular traffic, public transit service, and pedestrian and bicycle facilities outside of the DoD military bases. Guam's existing roadway network has developed into a multi-lane roadway system that serves commercial, retail, military, and tourist-based travel demands.

The Guam roadway network comprises the majority of Guam's non-military roadway system, providing the backbone of the island's passenger and goods movement routes (Figure 3.12.1-1). Construction of improvements to the Terrestrial Highway System are required to provide mission-critical transportation infrastructure as part of the planned construction, training, and operations associated with the proposed military relocation. The Guam roadway network must be able to accommodate increased traffic resulting from the proposed relocation of approximately 5,000 Marines with approximately 1,300 dependents to Guam once "steady-state" population in-migration conditions are in place after 2028 (see Section 4.15, Socioeconomics and General Services).

During the construction period, the temporary increase in the civilian labor force for construction and related activities would place further demand on the Guam roadway network.



Figure 3.12.1-1
Guam Roadway Network

Guam Island-Wide Traffic Model

The first Guam traffic model was developed in 2003. In 2008, the GDPW, in cooperation with the FHWA, oversaw the preparation of the 2030 Guam Transportation Plan (GDPW 2008) and the traffic impact analysis for the 2010 Final EIS (Volume 6, Related Actions, Chapter 4: Roadways, Section 4.2.1: Approach to Analysis, pages 4-39 to 4-202). As part of the development of this SEIS, the FHWA 2003 traffic model was updated and a new traffic analysis was conducted based on updated baseline conditions and the 2012 Roadmap Adjustments. This update to the model is hereafter referred to as the 2013 Guam Island-wide Traffic Model. The key input assumptions of the model include:

- Trip Purposes - Trips are split into four types: Home-based Work, Home-based Other, Non-home-based, and Commercial Vehicle. This classification system follows generally accepted industry practice for places where the available data does not support a more detailed disaggregation of trips.
- Trip Generation Rates - Trip generation rates used in the previous model are also used in the 2013 Guam Island-wide Traffic Model. These rates are within the normal range for the types of trips involved.
- Time of Day Factors - The time of day factors used for the weekday a.m. peak hour model are the same as those used in the previous model. Time of day factors used for the weekday p.m. peak hour model were adjusted to better match the latest traffic counts.

Documentation of the structure, input data and assumptions, and validation results are included in the Guam and CNMI Military Relocation (2012 Roadmap Adjustments) SEIS - Traffic Planning Model Development Report (FHWA 2013a).

Traffic forecasts used in this SEIS were developed using the 2013 Guam Island-wide Traffic Model. The 2030 forecasts indicate lower traffic volumes that result in significantly better operating conditions than the 2030 forecasts included in the 2010 Final EIS. The reduction in the scope of the DoD action contributes to the projected lower traffic volumes. However, most of the improvement is attributable to a downward revision in forecast growth rates for the civilian population on the island of Guam.

Although the new 2030 forecasts indicate improved conditions compared to the 2010 Final EIS forecasts, there is nevertheless a substantial worsening of traffic over existing conditions. This is primarily attributable to the estimated organic population growth. The results of the forecast are included in the Sketch-Level Traffic Analysis Report, the Traffic Operations Report, and the Supplemental Analysis (FHWA 2013b, 2013c, 2014).

Roadway Network Improvements

For scenarios forecasting future years, the 2013 Guam Island-wide Traffic Model roadway network file was revised to take into account widening or other capacity-increasing improvements expected to be completed by the forecast year (Year 2030). A subset of projects identified in the 2030 Guam Transportation Plan (GDPW 2008) with a high probability of being implemented by 2030 by the GDPW was assumed to be part of the baseline roadway network and, as such, is included in the 2013 Guam Island-wide Traffic Model Year 2030 roadway network. These roadway network improvements are identified in Table 3.12.1-1.

Table 3.12.1-1. Roadway Network Improvements Implemented By 2030

Route	*Project Limits*	*Project Description*
Route 3	Guam Regional Medical City Intersection	Construct new signalized intersection with turn lanes
Route 3	Okkodo High School Intersection	Construct new traffic signal. Provide second southbound through lane on Route 3
Route 8	Kanada-Toto Loop Road Intersection	Construct new traffic signal
Route 9	North side Newar Chalan Ramirez	Construct new ACE gate to provide access to AAFB internal roadway network
Route 10	Jesus Mariano Road	Construct new traffic signal
Route 10A	Route 1 to Airport	Widen from two to four lanes with a center turn lane
Route 10A	Airport to Route 16	Widen from two or three lanes to six lanes
Route 14B	Route 1 to Carmen Memorial Drive	Add center turn lane
Route 26	Route 1 to Route 25	Widen from two to four lanes. Construct new traffic signal and turn lanes at Route 26 / Route 25 (Alageta Road) intersection
Route 26	Route 25 to Route 15	Add center turn lane
Route 27 Ext	Route 16 to Route 1	Widen from two to four lanes. Signalize Route 1 / Route 27 intersection
Tiyan Parkway	Route 10A to Route 8	Construct four lanes plus a center turn lane. Signalize Tiyan Parkway / Route 8 intersection. Align Tiyan Parkway / Route 10A intersection with the existing signalized "T" intersection at Home Depot

Source: FHWA 2013b, 2013c, 2014.

Additionally, the Defense Access Road certified and eligible construction projects, including bridge replacements and pavement strengthening, identified in the 2010 Final EIS (Volume 6, Related Actions, Chapter 1: Purpose and Need for Actions, Table 1.1-1, page 1-8) would be implemented.

The purpose of proposed Terrestrial Highway System enhancements is to improve the existing network through the Defense Access Road program, or other funds, and provide mission-critical transportation infrastructure as part of the planned military relocation. A variety of roadway improvements are needed to support both construction of the facilities and the ensuing traffic related to the military relocation on Guam. The improvements proposed for the Terrestrial Highway System would result in increased roadway capacity, new access points, strengthened roadways, bridge replacements, and enhanced roadway safety on Guam, as a response to construction for the military relocation and growth.

An improved network of roadways on Guam is needed as part of the mission-critical infrastructure to support planned relocation of Marines and their dependents, as well as to accommodate ongoing growth on the island of Guam. To meet these needs, the existing roadway network capacities would be assessed against the projected travel demand resulting from the DoD-related actions, in order to identify those locations with deficiencies and potential impacts. These facilities at specific locations island-wide are then evaluated for feasibility and strategic implementation of roadway improvement projects such as roadway widening, intersection improvements, bridge replacements, and pavement strengthening projects, in order to ensure serviceability and to mitigate any potential impacts resulting from both the DoD-related actions and projected organic growth.

3.12.1.3 Transit

Public transportation on Guam includes the following modes and service types:

- Tour buses.
- Shopping buses.
- Taxis.
- School buses.
- Special service for DON shore leave.
- Fixed-route service (buses on designated routes at prescribed headways).
- Demand-Response Service (DRS) (reservation-type service linking residential areas with fixed-route service or nearby activity centers).
- Paratransit.

For purposes of this project, the transit discussion focuses on Guam Mass Transit. It describes the existing conditions for fixed-route, DRS areas, and paratransit service on Guam. DRS provides service by reservation to activity centers or areas with fixed-route service. It should be noted that there is some overlap between the fixed-route, DRS, and paratransit areas in the regions.

There are currently 7 fixed-route bus lines, 7 DRS areas, and 5 paratransit areas on the island. A section of Chamorro Village, located in Hagåtña, currently acts as a transit center consisting of a shared-use parking lot with two bus shelters. Only one route in the fixed system is not anchored by this location. In addition to the fixed routes, all DRS routes originate and terminate at Chamorro Village. In this respect, the current network acts as a low-frequency "pulse" system, having most of the routes service one central location simultaneously to maximize transfer potential.

The seven individual bus lines on the fixed-route service are the following:

- Greyline - servicing Dededo, Yigo, and surrounding areas.
- Redline - servicing Hagåtña, Mangilao, Barrigada, and Toto areas.
- Blueline 1 - servicing Hagåtña, Tamuning, Micronesia Mall, and Tumon areas.
- Blueline 2A - servicing Hagåtña, Asan, Piti, Agat, Umatac, and Merizo areas.
- Blueline Express - servicing Hagåtña, Tamuning, and Tumon areas.
- Greenline - servicing Yona, Inarajan, and Talofofo areas.
- Greenline Express - servicing Chamorro Village, Adelup, Agaña Heights, Sinajana, and Hagåtña areas.

Paratransit service, provided by the GRTA, supplies door-to-door transportation for persons with certified disabilities, and is available by advance reservation which must be made during normal business hours (8:00 a.m. to 5:00 p.m., Monday through Friday) on the day prior to the ride request and up to 2 days in advance. A total of six paratransit vehicles are assigned to paratransit services.

Effective March 1, 2013, all bus transit services for fixed-route and paratransit operate Monday through Saturday from 5:30 a.m. to 12:30 p.m. (a.m. run) and from 2:30 p.m. to 8:30 p.m. (p.m. run).

There are overall scheduling issues with mass transit on the island. Buses generally run ahead of the published schedule, and they do not adhere to slower speeds or wait time to follow the schedule. The lack of schedule adherence often causes passengers to miss the bus and thus does not provide a reliable public transportation system on Guam. Passengers are advised to be at the designated stop 15 minutes prior to scheduled departure time.

The GRTA was formed in 2010, and is currently responsible for all public transit functions. The 2030 Guam Transportation Plan outlines recommendations for an improved mass transit system on Guam. Additionally, the GRTA approved the Guam Transit Business Plan in January 2010, which includes purchasing new buses, constructing a bus maintenance facility, and modifying the bus schedule. The GRTA also received federal funding from the Federal Transit Administration, U.S. Department of Transportation in the amount of $1.5 million for the procurement of eight paratransit buses and four fixed-route buses. GRTA received Federal Transit Administration approval in late 2012 for a $1.3 million grant. Of the grant funds, $1 million would be used to fund construction of a new Guam Department of Integrated Services for Individuals with Disabilities Resource Center. The remaining $300,000 is allocated for the creation of a One Call-One Click Center.

Figure 3.12.1-2 illustrates the fixed routes and DRS areas in Guam. A DRS area is a geographical area that is served by the DRS type of bus service. DRS is available on-call and generally provides transportation to the nearest fixed route.

Annual ridership for the period January 2012 to December 2012 for fixed-route service includes 125,030 riders. A total of 37,420 riders utilized paratransit services during the same 12-month period.

3.12.1.4 Pedestrian and Bicycle Facilities

Guam has limited accommodations for pedestrian and bicycle travel. The type, quantity, and quality of pedestrian and bicycle facilities varies throughout the island. Sidewalks and roadway shoulders compose the existing pedestrian and bicycle system. Most of the 26 miles (42 km) of sidewalk is on the central western portion of the island, in the Hagåtña and Tumon Bay area. No marked or designated bicycle lanes or paths exist at this time. However, where no sidewalks are present, the shoulder generally functions as a pedestrian and bicycle space and is commonly used for running and cycling. The width and condition of roadway shoulders vary throughout the island. Shoulders are present along large segments of Route 1 and on Route 3 from Route 1 to Route 28. However, pedestrian and bicycle mobility and safety on road shoulders can be impeded by conflicting uses, such as parking.

Most of the signalized intersections included in this study contain a pedestrian indication on at least one of the intersection legs. Marked crosswalks and pedestrian safety devices are present at all signalized intersections. Crosswalks use the standard (i.e., two parallel lines) or continental marking pattern (i.e., wide, dashed, perpendicular lines). The physical condition of pedestrian facilities generally mirrors the condition of adjacent roadway facilities, and is deteriorated in some areas. Sidewalks often contain obstructions such as fire hydrants, power poles, traffic signal controllers, or other utilities.

Pedestrian/auto accidents are known to occur at various locations on Guam. Most of these accidents occur at night in areas where street lighting levels are low and where pedestrian crosswalks either do not exist, are not clearly marked, or are spaced too far apart. In addition, along village streets, there is a lack of sidewalks and, in many instances, minimal shoulder space for pedestrians.



Figure 3.12.1-2
Existing Transit Service

Data Sources: GRTA 2013; NAVFAC Pacific 2013

Guam Public Law 29-98 requires the consideration and construction of bicycle and pedestrian paths with all new roadway construction projects. The 2030 Guam Transportation Plan (GDPW 2008) also identifies a plan for bicycle facilities that includes detached paths, paved shoulders, and wide outside lanes, depending on the roadway. Bicycle and pedestrian improvements would be incorporated into the off-base roadway improvement project as much as practicable.

3.12.2 Regulatory Framework

Applicable laws, regulations, and standards include FHWA environmental regulations (23 CFR § 771); FHWA Technical Advisory T6640.8A (Guidance for Preparing and Processing Environmental and Section 4(f) Documents) (FHWA 1987); FHWA Section 4(f) Regulations (23 CFR § 774—Parks, Recreation Areas, Wildlife and Waterfowl Refuges, and Historic Sites (Section 4(f)); the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (23 USC 139); and Moving Ahead for Progress in the 21st Century (MAP-21). Additionally, Guam Public Law 29-98 requires the consideration and construction of bicycle and pedestrian paths with all new roadway construction projects. The FHWA would be responsible for obtaining all permits required for construction of off-base roadway projects.

The aforementioned laws, regulations, and standards in this section, as well as those in applicable environmental resources, form the networked management framework that embodies the Guam Coastal Management Program's enforceable ground transportation policy that the proposed action alternatives must be consistent with, to the maximum extent practicable. The policy specifically states that "Guam shall develop an efficient and safe transportation system, while limiting adverse environmental impacts on primary aquifers, beaches, estuaries, coral reefs, and other coastal resources."

3.12.3 Approach to Analysis

3.12.3.1 Methodology

On-Base Roadways

For on-base roadways, the travel demand of the current base land uses was compared to the projected travel demand anticipated to be generated by the proposed action. A planning-level on-base traffic analysis was used to assess any potential transportation impacts related to the DoD action, and to identify potential mitigation options. The proposed action includes on-base (internal) roadway construction projects that would be implemented by the DoD. On-base (internal) roadway segments, intersections, and entry control facilities have been designed to accommodate the expected travel demand. Specifically, on-base (internal) roadway segments and intersections are designed to operate at acceptable LOS (LOS A, B, C, D, or E) under future year (Year 2030) conditions with the proposed action. Therefore, the proposed action would not result in a significant impact to any on-base (internal) roadways or intersections.

Off-Base Roadways

Existing traffic volumes for all study roadways and intersections were obtained from traffic counts conducted by the GDPW in 2012. The 2013 Guam Island-wide Traffic Model was calibrated against these recent counts. Traffic forecasts were prepared using the 2013 Guam Island-wide Traffic Model, an updated version of the model that was used for the 2010 Final EIS traffic analysis. The 2013 version incorporates data from the 2010 U.S. Census, the 2007 Economic Census, new forecasts for population growth unrelated to military projects, and an improved representation of the Terrestrial Highway System.

Four potential cantonment/family housing alternatives and five potential LFTRC alternatives are under consideration. The travel demand modeling methodology for the alternatives and combination of alternatives was defined and directed by the DoD and the FHWA to provide detailed off-base (external) roadway and intersection analysis for one representative pairing (the modeled combination) for a cantonment/family housing alternative and LFTRC pairing. The following scenarios were modeled:

- Existing (Year 2012) Baseline Conditions (FHWA 2013c).
- Year 2030 No Build Baseline Conditions (FHWA 2013c).
- Year 2030 Finegayan (Alternative A) with NWF LFTRC (Alternative 5) (FHWA 2014).
- Year 2030 Finegayan-South Finegayan (Alternative B) with NAVMAG (East/West or L-Shaped) LFTRC (Alternative 2 or 4) (FHWA 2013b).
- Year 2030 AAFB (Alternative C) with NAVMAG (East/West or L-Shaped) LFTRC (Alternative 2 or 4) (FHWA 2013b).
- Year 2030 Barrigada (Alternative D) with NWF LFTRC (Alternative 5) (FHWA 2013b).
- Year 2030 No-Action Alternative Conditions (FHWA 2013b).

The Baseline Conditions scenarios represent the expected traffic growth on the island for Year 2030 without DoD action, and are considered to be the baseline conditions against which the "steady state" of the proposed action alternative would be compared. The No-Action Alternative Conditions scenario presumes the present course of action identified in the September 2010 ROD. All future scenarios assume completion of the roadway improvements identified in Table 3.12.1-1.

Traffic impacts of the proposed action cantonment/family housing and LFTRC alternatives and the No-Action Alternative were determined through a quantitative analysis of existing and future traffic volumes. It should be noted that there is typically a direct relationship between impacts on transportation resources and increase or decrease in population. Consequently, compared to the transportation (roadway) resource impacts described in the 2010 Final EIS, the magnitude of the impacts resulting from implementation (construction and operations) of the proposed action assessed in this SEIS would be smaller.

Roadway Segment Operations

This transportation impact analysis compares the existing capacity and demand on a roadway to the projected capacity and demand of that roadway. A principal objective of capacity analysis is the estimation of the maximum amount of traffic that can be accommodated by a given facility while maintaining desired operational qualities. Roadway segments were analyzed by comparing the 2013 Island-wide Traffic Model's forecast traffic volumes to the LOS thresholds summarized in Table 3.12.3-1.

The capacity thresholds distinguish between rural and transitional (semi-urban) areas (Table 3.12.3-1). For the purposes of this study, the rural areas include Route 9, the northern portion of Route 3, Route 3A, the southern portion of Route 1, Route 6, and Routes 2 and 4 in the southern portion of the island. Capacity thresholds are provided for the corresponding LOS with LOS F conditions occurring when traffic volume on the roadway exceeds the maximum capacity identified in the LOS E column. These LOS thresholds are based on research conducted and published by the Florida Department of Transportation using the methodologies in the *Highway Capacity Manual* (Transportation Research Board 2010). The Florida Department of Transportation tables are commonly used for planning purposes by jurisdictions across the U.S.

Table 3.12.3-1. Peak Hour Directional Level of Service Thresholds

Number of Lanes	*Median Type*	*Vehicles Per Hour*		
		LOS A, B, or C	*LOS D*	*LOS E*
Class 2 (Posted speed 35 mph [56 km/h] or lower, Rural areas)				
1	Undivided	670	740	NA
1	Divided with left-turn lanes	704	777	NA
2	Undivided without turn lanes	1,224	1,264	NA
2	Divided with left-turn lanes	1,530	1,580	NA
3	Divided with left-turn lanes	2,360	2,400	NA
Class 2 (Posted speed 35 mph [56 km/h] or lower, Transitional urban areas)				
1	Undivided	330	680	720
1	Divided with left-turn lanes	347	704	756
2	Undivided without turn lanes	400	1,168	1,280
2	Divided with left-turn lanes	500	1,460	1,600
3	Divided with left-turn lanes	810	2,280	2,420

Notes: Thresholds are per direction and indicate the maximum value to achieve the LOS. The weekday a.m. and p.m. peak hours on Guam occur between 8:00 a.m. and 9:00 a.m. and 4:30 p.m. and 5:30 p.m., respectively. NA indicates that volumes exceeding LOS D become LOS F because intersection capacities are reached.

Sources: FHWA 2013a, 2013c.

Roadway segments were analyzed by direction during the weekday a.m. and p.m. peak hours (occurs between 8:00 a.m. and 9:00 a.m., and 4:30 p.m. and 5:30 p.m., respectively) for every link in the 2013 Guam Island-wide Traffic Model. It is common for one travel direction of a roadway segment to experience a higher volume of traffic than the opposite direction during any given hour. The volume-to-capacity ratio for both directions of travel is reported for each study roadway segment.

Intersection Operations

The operations of signalized and unsignalized intersections along the major street network across the island were analyzed. The study intersections were evaluated using the methodologies outlined in the *Highway Capacity Manual* (Transportation Research Board 2010). Intersection LOS calculations, included in Appendix F, were computed using Trafficware's Synchro software package. The duration of delay is measured differently for signalized intersections compared to unsignalized intersections. Because an unsignalized intersection does not generally have as much traffic as a signalized intersection, the LOS delay is typically shorter than at a signalized intersection. At signalized study intersections, the operations analysis uses various intersection characteristics (e.g., traffic volumes, lane geometry, and signal phasing/timing) to estimate the average control delay experienced by motorists at an intersection. At unsignalized (one-way, two-way, and all-way stop-controlled) study intersections, LOS is related to the total delay per vehicle at the intersection as a whole (for all-way stop-controlled intersections) or for each stop-controlled approach (for one- and two-way stop-controlled intersections). Total delay is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs the queue. This time includes the time required for a vehicle to travel from the last-in-queue position to the first-in-queue position. Table 3.12.3-2 provides the delay thresholds for signalized and unsignalized intersections.

Table 3.12.3-2. Intersection Level of Service Definitions

LOS	*Description of Traffic Conditions*	*Average Delay (seconds per vehicle)*
Signalized Intersections		
A	Insignificant Delays: No approach phase is fully utilized and no vehicle waits longer than one red indication.	≤ 10.0
B	Minimal Delays: An occasional approach phase is fully utilized. Drivers begin to feel restricted.	> 10.0 and ≤ 20.0
C	Acceptable Delays: Major approach phase may become fully utilized. Most drivers feel somewhat restricted.	> 20.0 and ≤ 35.0
D	Tolerable Delays: Drivers may wait through more than one red indication. Queues may develop but dissipate rapidly, without excessive delays.	> 35.0 and ≤ 55.0
E	Significant Delays: Volumes approaching capacity. Vehicles may wait through several signal cycles and long vehicle queues from upstream.	> 55.0 and ≤ 80.0
F	Excessive Delays: Represents conditions at capacity, with extremely long delays. Queues may block upstream intersections.	> 80.0
Unsignalized Intersections		
A	No delay for stop-controlled approaches.	≤ 10.0
B	Operations with minor delays.	> 10.0 and ≤ 15.0
C	Operations with moderate delays.	> 15.0 and ≤ 25.0
D	Operations with some delays.	> 25.0 and ≤ 35.0
E	Operations with high delays, and long queues.	> 35.0 and ≤ 50.0
F	Operation with extreme congestion, with very high delays and long queues unacceptable to most drivers.	> 50.0

Source: Transportation Research Board 2010.

3.12.3.2 Impact Assessment Criteria

Direct and Indirect Impacts

Impacts related to the DoD's proposed action to relocate approximately 5,000 Marines and approximately 1,300 dependents can be identified as direct or indirect (or induced) impacts.

For roadways and intersections, direct impacts relate to the demand for roadways by the military population and facilities. A direct impact is an effect caused by the proposed action and occurs at the same time and place. Direct impacts related to roadways are analyzed and discussed in detail.

Indirect impacts generally relate to the increased demand for the roadways due to increases in the civilian population and facilities. There are two main contributors to indirect impacts for roadways: the construction workforce that would come to Guam, and induced civilian population growth from increased economic activity, both related to the proposed military relocation. Anticipated civilian population growth in the absence of the military relocation has been considered in the forecast of future demand for roadways, but is not a major contributor. Indirect impacts related to roadways and intersections are analyzed and discussed, although the analysis is more general and qualitative in nature; using readily available information from owners and operators of these systems, as well as from regulatory agencies.

Assessment Criteria

The project would have a significant impact on the environment if it would conflict with an applicable plan, ordinance, or policy that establishes measures of effectiveness for the performance of the circulation system. The assessment takes into account all modes of transportation; including mass transit and non-motorized travel and relevant components of the circulation system. Relevant components of the

circulation system include, but are not limited to; intersections, streets, highways and routes, pedestrian and bicycle paths, and mass transit.

Traffic Load and Capacity Thresholds

For intersections and roadway segments, the LOS rating deemed acceptable typically varies by jurisdiction, facility type, and traffic control device. LOS D is generally recognized as the minimum desirable operating condition. However, according to the 2030 Guam Transportation Plan it is recommended that, "All intersections and roadway segments should operate at LOS E during peak periods. Improvements undertaken by the GDPW would be designed to alleviate substandard LOS conditions to the extent feasible, with due consideration to physical and environmental constraints" (GDPW 2008).

The desired threshold for acceptable operating conditions at intersections and roadway segments is LOS E or better. Intersections and roadway segments operating at LOS F would be considered unacceptable. Consistent with the 2010 Final EIS (Volume 6: Chapter 4, Section 4.2.1.1: Methodology, page 4-40), a significant traffic impact is deemed to occur if:

- *For roadway segments and intersections* - the proposed action causes LOS to change from acceptable LOS (LOS A, B, C, D, or E) to unacceptable LOS (LOS F).
- *For roadway segments* - if the roadway segment is operating at unacceptable LOS (LOS F) under Year 2030 Baseline Conditions, and continues to operate at unacceptable LOS F with the proposed action, then a significant impact would be deemed to occur if the proposed action adds 5% to the total traffic on the roadway segment.
- *For intersections* - if the intersection is operating at unacceptable LOS (LOS F) under Year 2030 Baseline Conditions, and continues to operate at unacceptable LOS F with the proposed action, then a significant impact would be deemed to occur if the proposed action adds 50 vehicles to the intersection.

Other Thresholds

The proposed action would have a significant impact on the environment if it would:

- *For entry control facilities* - provide inadequate stacking distance, or result in excessive queuing that would affect operations of adjacent roadways or intersections under Force Protection Condition (FPCON) Bravo+ conditions.
- *For pedestrians and bicyclists* - substantially increase traffic hazards to motor vehicles, bicycles, or pedestrians due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with applicable design standards.
- *For transit, pedestrians and bicyclist* - fundamentally conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities; or otherwise decrease the performance or safety of such facilities.
- The indirect and cumulative impacts of the proposed action associated with induced civilian population growth, workforce housing, and logistics; as well as their significance, have been identified. In making these assessments, industry and regulatory standards were employed to make the determinations of impacts and significance.

3.12.3.3 Public Scoping Issues

The scoping comments/concerns regarding ground transportation are summarized as follows:

- Potential impacts from military expansion activities resulting in increased traffic around military bases, as well as residential areas off-base.
- Potential impacts from military expansion activities resulting in increased traffic on Marine Corps Drive (Route 1) and Route 4, specifically if the LFTRC is located at NAVMAG (Alternative 2, 3, or 4).
- Potential impacts from military expansion activities resulting in increased traffic on Route 3A, specifically if the LFTRC is located at NWF (Alternative 5).
- Potential impacts from military expansion activities resulting in the proposed diversion of Route 15; a major highway on Guam, specifically if the LFTRC is located at Route 15 (Alternative 1).
- Potential impacts from military expansion activities resulting in new access roads to NAVMAG (East/West) LFTRC (Alternative 2) and NAVMAG (L-Shaped) LFTRC (Alternative 4). Construction and operations of new access roads would potentially result in an impact to environmentally sensitive watersheds in southern Guam. Improvement of the existing Bubulao Road, off of Route 4A, should be considered to minimize impacts to the environmentally sensitive areas.
- Potential impacts from military expansion activities that would require Marine Corps personnel located in northeastern Guam to travel on already congested roadways, specifically if the LFTRC is located at any NAVMAG (East/West, North/South, or L-Shaped) (Alternative 2, 3, or 4) site.

3.13 MARINE TRANSPORTATION

3.13.1 Definition

Marine transportation refers to marine vessels and facilities used to support commercial, military, and recreational uses. Marine transportation could be impacted by the proposed alternatives through restricted vessel access to port facilities. Additionally, use of firing ranges could be affected by marine vessels traveling within marine waters (including shipping lanes) within the designated SDZs. Marine transportation is discussed in detail in the 2010 Final EIS (Volume 2, Chapter 14: pages 14-1 to 14-9).

3.13.1.1 Description of Port Facilities

The primary military, commercial, and recreational port facilities on Guam are located in Apra Harbor, the main berthing facility on the island. About 90% of marine transportation in Guam is conducted in Apra Harbor. Any vessel traffic associated with the proposed action would berth in Apra Harbor. Apra Harbor provides deep water and protected loading and off-loading facilities. Apra Harbor consists of a commercial harbor, naval complex, and repair facility. The port handles both containerized and conventional cargo from the U.S. and other countries. A more detailed description of Apra Harbor, including the condition of facilities and current levels of use, is included in Section 4.1.13 of this SEIS.

3.13.1.2 Designated Shipping Lanes

Vessel traffic in U.S. ports and harbors is governed by a system of traffic separation schemes. Traffic separation schemes are internationally recognized routing designations created by the Coast Guard that separate opposing flows of vessel traffic into lanes (also called fairways), including a zone between lanes where traffic is to be avoided (33 CFR § 166). Safety fairways are corridors in which no artificial island or fixed structure, whether temporary or permanent, is permitted (33 CFR § 167). The shipping lanes, which are also delineated by a series of geographic coordinates, provide unobstructed approaches for vessels using U.S. ports. Vessels are not required to use the lanes, but failure to use one, if available, would be a major factor for determining liability in the event of a collision with another ship or an underwater structure. Shipping lanes in the vicinity of Guam are shown in Figure 3.13.1-1.

Commercial ships travel from U.S. west coast ports (e.g., Ports of Long Beach, Oakland, Tacoma) through the Port of Honolulu and on to the Port of Guam. Depending on the shipping line, ships depart from the Port of Guam for various port locations in China (Ports of Ningbao and Shanghai), Hong Kong, Taiwan (Ports of Kaoshiung and Keelung), Philippines (Port of Davao), Japan (Ports of Yokohama, Nagoya, and Kobe), and South Korea (Port of Busan). There is no direct service from U.S. mainland ports, although there is direct service from Hawaii to Guam. However, no direct service exists from Guam to Hawaii or any other U.S. port of entry. Shipments from Guam travel westward on ships bound for Asia, with some vessels then traveling eastward across the Pacific to the U.S. west coast ports.

3.13.2 Regulatory Framework

Most of Outer Apra Harbor and the entire Inner Apra Harbor are under the jurisdiction of the DON. Use of these waters is restricted because they are adjacent to Naval Base Guam facilities. The operation of commercial vessels in Outer Apra Harbor is regulated by the Harbor Rules and Regulations of the Port Authority of Guam (PAG) (Public Law 26-72).

3.13.3 Approach to Analysis

3.13.3.1 Methodology

The proposed action could potentially impact marine transportation through potential delays in unloading/loading of ships due to reduced availability of port facilities from an increase in the number of vessels and vessel-handling requirements. Additionally, closure of the SDZs could interfere with vessel travel patterns during the use of firing ranges.

To determine the impacts of the proposed cantonment and family housing alternatives on available port facilities, the anticipated annual number of vessels that would visit Apra Harbor for each alternative has been compared to projected port mooring, crane, and storage capacity. The recent trend of vessel visits and volume of cargo was analyzed and extrapolated, and a comparison was made with the anticipated maximum number of vessels that would visit the harbor during the embarkation period (FY 2014 through FY 2022, the largest increase in vessel traffic by the proposed alternatives). Baseline and alternative forecasts are provided within the Port of Guam Master Update (PAG 2013). Potential significant impacts are assumed to occur if annual vessel visits or volume of cargo exceeds a threshold where processing time would increase or demand would exceed current capacity.

To determine the impact of marine transportation on LFTRC alternatives, the location of the proposed range SDZs were evaluated to determine potential conflict due to levels of vessel use of marine areas.

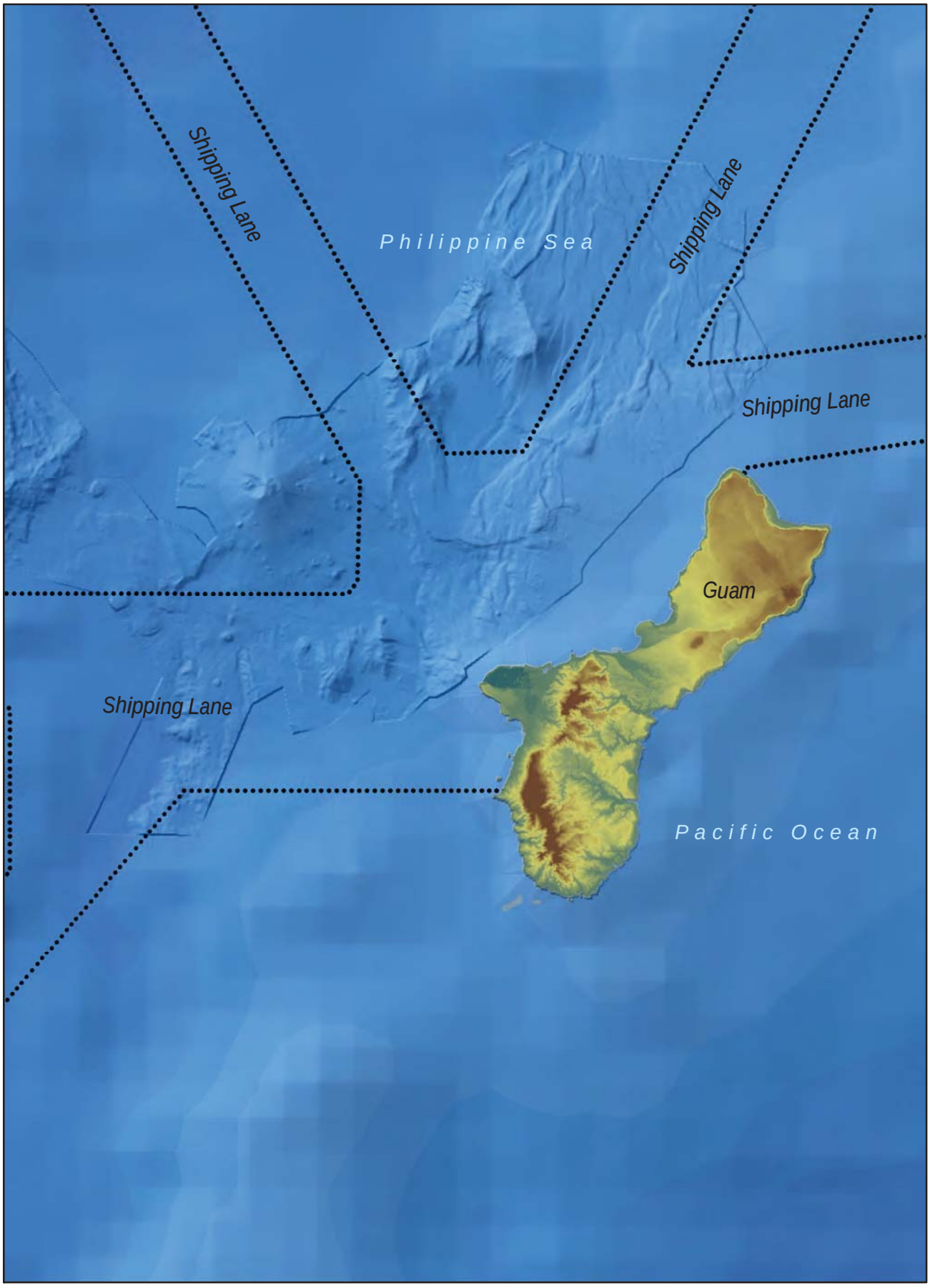


Figure 3.13.1-1
Guam Shipping Lanes

3.13.3.2 Impact Assessment Criteria

A significant adverse impact to marine transportation would be determined if the proposed action significantly interfered with usage of the Port of Guam by commercial or recreational marine traffic. For the proposed action, there is a concern that vessels would not have timely access to port facilities during the embarkation period.

The increased number of vessel visits due to the proposed action has the potential to cause an increase in processing times at the harbor facilities. The magnitude of the predicted impact depends on if the increased vessel visits will cause a delay beyond what has been historically experienced at Apra Harbor. Detailed comparisons of specific types of ship (that require particular dock facilities) would be warranted if the number of visits of that type of ship is predicted to increase. These criteria are used in analysis because it is impossible to accurately predict the annual traffic capacity of the port facilities.

Where the SDZ extends over marine waters that are used by commercial or recreational vessels, an impact to vessel traffic is possible. The impact would be significant if the closure of the SDZ would cause a disruption in established marine traffic patterns, including interrupting known shipping routes or schedules.

3.13.3.3 Public Scoping Issues

The DON received no comments pertaining to marine transportation during public scoping for this SEIS.

3.14 UTILITIES

3.14.1 Definition

Utilities refers to what is typically public utilities that are provided to the general population for basic services, including electrical power, potable water, wastewater services, municipal solid waste, and IT/COMM. In the case of military installations on Guam, some utilities are provided by DoD utility systems. In some instances, these DoD utility systems extend off-base, beyond installation boundaries. DoD utility systems extending beyond the boundaries of the cantonment and LFTRC alternatives are referred to as off-site utilities. Guam's utilities are defined and described in the following sections, and additional information regarding utilities as they relate to the action alternatives is provided in the utilities sections in Chapters 4 and 5 of this SEIS.

3.14.1.1 Electrical Power

The GPA provides all the electrical power used on-island by both civilians and the DoD. In cases of local or island-wide power outages, the DoD has dedicated emergency (standby) generators to maintain power to critical DoD facilities. A number of emergency (standby) generators are permitted and are operated under permitted conditions.

In addition to electrical power generation, the power systems also include substations, transmission lines, and distribution lines. The GPA owns and operates most of the island-wide transmission lines and substations. The DoD owns some off-base transmission lines and leases these to the GPA, which operates and maintains them. The DoD owns and operates substations and distribution lines serving many of their installations. Fuel storage tank farms, fuel pipelines, pumping facilities, and cooling water systems, including intakes and outflows, are also part of the power systems.

3.14.1.2 Potable Water

There are three distinct potable water systems on Guam. One system is owned and operated by the GWA, which serves the general civilian population on Guam. The other two systems are owned and operated by the DoD and serve most of the military installations on Guam. The DoD systems consist of the DON and Air Force systems. While these systems are being transitioned for operation by the DON under a joint region arrangement, their current status is that they are not fully integrated. The water systems include water production wells, surface impoundments, springs, transmission lines, water treatment facilities, pump stations, storage tanks, and distribution lines. Most water production for the central and northern parts of Guam is derived from water wells fed by the NGLA. Most water production for the southern parts of Guam is derived from springs and surface water impoundments, principally Fena Reservoir, a DoD resource.

3.14.1.3 Wastewater

The GWA owns and operates most of the WWTPs on Guam, except for the Apra Harbor WWTP, which is a DoD asset that primarily serves Naval Base Guam. The off-base collection systems on the island are all owned and operated by the GWA, except for those that are part of the Apra Harbor WWTP system. The on-base wastewater collection systems are owned by the DoD, but feed into main lines owned by the GWA (except for those feeding into the Apra Harbor WWTP). The wastewater systems include sewers, WWPS, treatment plants, and ocean outfalls.

3.14.1.4 Solid Waste

The main municipal solid waste landfill on Guam is the Layon Landfill owned by GovGuam. Transfer stations are located around Guam and facilitate municipal solid waste transportation to the Layon Landfill. The DoD currently has one recycling center and one transfer station on AAFB, but disposes its municipal solid waste at the Layon Landfill. The DoD owns and operates two landfills on their installations (i.e., Naval Base Guam and AAFB). The DON is currently coordinating with the GEPA regarding the status of the permit for the Naval Base Guam Landfill. The proposed action would be consistent with solid waste permit terms and conditions.

3.14.1.5 Information Technology/Communications

For IT/COMM, there are two systems: a commercial system and a DoD system. The commercial system provides basic internet, telephone, and television services. The DoD system is completely separate from the commercial system and provides necessary communications infrastructure to facilitate DoD operations. The IT/COMM systems typically consist of cables within buried conduit, encased in concrete, running between manholes/handholes.

3.14.2 Regulatory Framework

3.14.2.1 Electrical Power

The GPA comes under the control of the Consolidated Commission on Utilities for their budgets and rate structure, and USEPA Region 9 and the GEPA for emissions and operating permits. The GPA is subject to all applicable regulatory requirements, such as the CAA, CWA, Spill Prevention Control and Countermeasures Plan Compliance, Oil Pollution Prevention Regulation, Resource Conservation and Recovery Act, Toxic Substance Control Act, and the Environmental Planning and Community Right-to-Know Act.

3.14.2.2 Potable Water

Potable water is regulated by the GEPA and USEPA Region 9. While the USEPA has delegated primary enforcement authority for the federal Safe Drinking Water Act and its implementing regulations to the GEPA, the USEPA retains the authority to enforce all federal regulations and requirements. The GWA is currently operating under a court order filed in November 2011, which is an amendment to the original 2003 Stipulated Order for Preliminary Relief to address violations of the Safe Drinking Water Act and the National Primary Drinking Water Regulations. The GWA water compliance background is presented in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1.2: Potable Water, pages 3-7 to 3-17) and is summarized and updated in the Affected Environment sections for Utilities in Chapter 4. In 2013, GWA reported substantial progress towards achieving overall compliance with USEPA requirements. However, the latest National Enforcement Investigations Center (NEIC) inspection report on GWA's potable water system conducted in 2012 found deficiencies in GWA's wells, water sources, distribution system, and storage tanks, as well as issues with management and operations. Details of the deficiencies, completed improvements, and the current status of relevant compliance requirements are discussed in Section 4.1.14.1.

The DON owns and operates the Fena Water Treatment Plant and the associated water transmission and distribution systems. The Fena Water Treatment Plant is subject to the USEPA Safe Drinking Water Act. Recently, there has been concern about exceeding drinking water standards for disinfection byproducts. The DON has remained in compliance by implementing short-term measures to reduce disinfection byproducts and continues to pursue long-term solutions and work with the GWA to jointly address this issue.

3.14.2.3 Wastewater

Wastewater is regulated by the USEPA Region 9 and the GEPA. The GWA owns, operates and maintains seven WWTPs on Guam, as well as the associated wastewater collection systems to transport sewage to the WWTPs. GWA WWTPs discharging to U.S. waters are subject to the conditions and limitations contained in NPDES permits issued by USEPA pursuant to the CWA. GWA's wastewater compliance background is presented in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1.3: Wastewater, pages 3-17 to 3-30) and is summarized and updated in the Affected Environment sections for Utilities in Chapter 4. The current major wastewater compliance requirements and issues for the GWA are covered under a 2011 court order, a USEPA NEIC inspection conducted in 2012, and revised NPDES permits issued in April 2013, which require upgraded treatment of wastewater for the Northern District WWTP and the Agaña WWTP.

The 2011 court order is not a permit, or a modification of any permit, under any federal, state, or local laws or regulations. The GWA is responsible for achieving and maintaining complete compliance with all applicable federal, state, and local laws, regulations, and permits. The revised NPDES permits for both the Northern District WWTP and the Agaña WWTP established discharge limits consistent with secondary treatment and Guam Water Quality Standards, including those for nutrients.

The DON owns and operates the Apra Harbor WWTP and the associated wastewater collection system. The Apra Harbor WWTP is subject to the conditions and limitations contained in the NPDES permit issued by the USEPA pursuant to the CWA. The DON continues to work with the USEPA under a federal facility compliance agreement to achieve compliance at this facility. The DON compliance background is presented in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1.3.5: Apra Harbor WWTP, pages 3-26 to 3-28).

3.14.2.4 Solid Waste

Municipal solid waste landfills on Guam are regulated by the GEPA. The USEPA provides the territory with criteria, information, guidance, policy, and regulations to help the GEPA and the regulated community make better decisions in dealing with a broad range of solid waste issues in accordance with federal law and related programs.

In February 2004, the USEPA, Department of Justice, and the GovGuam entered into a Consent Decree to resolve issues related to unauthorized discharge of pollutants under the CWA to the Lonfit River from the existing Ordot Dump, as discussed in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1.4: Solid Waste, pages 3-31 to 3-38). The Guam Solid Waste Authority is managed by the Federal Receiver (Gershman, Brickner, and Bratton, Inc.), pursuant to Orders of the District Court of Guam. The Receivership is responsible for all of the operations of the Guam Solid Waste Authority and implementation of the Consent Decree entered by the GovGuam and the USEPA in 2004. The Receivership would continue until the Consent Decree is fully implemented or is otherwise terminated by the District Court.

The Guam Solid Waste Authority was created as an autonomous, public corporation when Public Law 31-20 became law on April 4, 2011. This legislation established the Guam Solid Waste Authority under the Department of Public Works to handle the operations of what was formerly the Solid Waste Management Division. The legislation's stated objective is to achieve the GovGuam's eventual resumption of all functions, responsibilities, and authority for solid waste management and operations, and the governance thereof.

3.14.2.5 Information Technology/Communications

The Federal Communications Commission regulates cable television service. Installation of IT/COMM infrastructure is subject to standard regulations regarding construction of utilities on Guam.

3.14.3 Approach to Analysis

3.14.3.1 Methodology

The impact analysis for utilities compares the existing capacity and demand on a utility to the projected capacity and demand. This analysis is done for each of the action alternatives. Military and civilian populations on Guam are projected to increase as a result of the proposed military relocation. In general, projected population changes are used to forecast future demand for a utility, based on average per capita usage, plus both commercial and industrial uses. Estimated demand for the power utility is based primarily on proposed facilities and, in some cases, population. Changes in facility usage and new facility construction would also potentially contribute to the total projected demand. Demand projections are then compared to the planned capacity under each utility alternative.

In Chapter 4 of this SEIS, the affected environment and potential impacts are addressed for each of the proposed cantonment/family housing alternatives. This would consist of the ability of a utility (after modified as proposed) to properly handle and provide required services to both DoD and civilian customers. The analysis also considers the island-wide impacts from induced civilian growth and projected organic civilian growth that would be expected to occur without the proposed action. Chapter 5 describes the affected environment and potential impacts on utilities associated with implementation of the proposed LFTRC alternatives. Chapter 6 evaluates the additional impacts to utilities (i.e., in addition to those described in Chapters 4 and 5 for each alternative) that would result when a particular cantonment/family housing site alternative is paired with a particular LFTRC alternative.

3.14.3.2 Impact Assessment Criteria

For this assessment, determination of a significant adverse effect is made when the projected increase in demand for a utility would exceed the available or planned capacity for that utility, such that the utility system would provide substandard service to other areas for existing customers as a result. A significant adverse effect would also be determined should a utility not be able to operate within the parameters of their regulatory requirements. This evaluation pertains to whether the utility is operating within the design and capacity (taking into account the current condition of the infrastructure) of its systems, and/or whether the pre-proposed action status of a utility is within the parameters of its regulatory requirements. For example, if a utility would operate within the design and capacity of its systems with the additional estimated demands of the proposed action, but is expected to be operating in violation of its regulatory requirements when the proposed action would occur, there would be a determination of significant adverse impact. In a situation where a utility is currently operating in violation of regulatory requirements and the proposed action would utilize this utility above a negligible amount, there would be a determination of significant adverse impact as well.

A determination of no impact would be made if a utility is forecast to operate within its proposed capacity and in compliance with its permits. The utility assessments included all known present and future projects anticipated on Guam for DoD, GovGuam, and forecast civilian growth (induced by the proposed action and normal expected growth) through the year 2028. Any increase in utility requirements beyond that would be the normal responsibility of the utility agencies and has not been included in this impact determination.

3.14.3.3 Public Scoping Issues

The scoping comments/concerns regarding utilities are summarized as follows:

<u>Electrical Power</u>

- Any required refurbishment of combustion turbines for the generation of power should be in consultation with the GPA and the USEPA regarding whether this would qualify as routine maintenance, repair, and replacement; which, by rule, do not trigger a Prevention of Significant Deterioration permit modification. Given the age of these turbines however, the refurbishment might be categorized as "modifications" that would require an evaluation of potential emission increases.
- Concern regarding additional air emissions from any refurbished combustion turbines to generate electric power.

<u>Potable Water</u>

- Potable water needs inclusive of temporary contractors and construction workers should be estimated, and should take into account the estimated 50% unaccounted for water in the GWA water system.
- Required new drinking water sources should be identified. All treatment, storage, and distribution issues should be discussed.
- The NGLA should be discussed in regard to its sustainable yield. An updated estimate of that sustainable yield at the basin level should be provided.
- Options and plans for long-term water management on Guam should be discussed, such as formation of workgroups or other cooperative entities to develop long-term management strategies for potable water, including management of the NGLA.

- Any potential potable water shortfalls due to military expansion should be addressed, including a DoD commitment to implement a coordinated U.S. Government - GovGuam strategy for both funding and technical support for capital improvement projects needed to address these potential shortfalls.
- Provide information on how DoD would coordinate with the USEPA and GEPA to ensure compliance with all regulatory requirements for any new or substantially modified public drinking water systems.
- Identify the regulatory requirements that would apply should the groundwater be classified as groundwater under the direct influence of (GWUDI) surface water by the GEPA.
- Concerns that live-fire training could contaminate drinking water sources, including the NGLA (from the HG Range at Andersen South) and Fena Reservoir (from NAVMAG LFTRC alternatives). Note: this is more of a water resource issue than a potable water utility issue and thus is covered in Section 3.2.
- The calculation of water demand should not include assumptions that existing DoD facilities would reduce their overall water demand unless specific conservation measures are part of the proposed action.

Wastewater

- Explain the estimated increase in wastewater flows, including that from induced civilian growth and imported construction workforce, and how this increase of wastewater flows would be treated and disposed of in a manner consistent with the CWA.
- It is recommended that the DoD coordinate with the GWA on expansions and upgrades to any WWTP that would see a significant project related growth in wastewater flows within their service area.
- Use of any existing sewage collection systems should include a review of these collection systems for adequate capacity and integrity.
- Increases in wastewater flows to the Apra Harbor WWTP should examine how these increases could impact work being done under the current federal facilities compliance agreement.

Solid Waste

- The SEIS should include an integrated solid waste management plan.
- The SEIS should include a waste characterization study of the existing DoD waste stream.
- The SEIS should include a plan to address special waste not accepted by the Layon Landfill.
- The SEIS should include a mandatory recycling plan.
- Address aircraft carrier waste.
- Identify the DoD solid waste planning hierarchy and goals of EO 13514 and how these goals would be met for the proposed action.
- Address the quantity of construction and development (C&D) materials that would be expected and how they would be managed and if there is sufficient hardfill capacity.
- Discuss options for reducing and managing organic materials and diverting them from landfills, including green waste from vegetation clearing.
- Estimate future quantities of waste, including induced population growth and imported construction workforce increases, and evaluate how that waste would be managed. Identify any expected needs that would be the responsibility of the GovGuam.

Information Technology and Communications

During the public scoping process, there were no concerns expressed regarding IT/COMM.

3.15 SOCIOECONOMICS AND GENERAL SERVICES

3.15.1 Definition

Guam's socioeconomic attributes and general services are defined and discussed in detail in the 2010 Final EIS (Volume 2, Chapter 16: Socioeconomics and General Services, Section 16.1: Affected Environment, pages 16-1 to 16-67). Socioeconomics is defined as the basic attributes and resources associated with the human environment. Socioeconomic "resources" include population size and demographics; employment and income; economic activity (including interaction of economic sectors with the military); general services such as government-funded health and human services; social cohesion (including, but not limited to, Chamorro issues and military-civilian relations); and land acquisition as it pertains to economic activity and sociocultural effects.

3.15.2 Regulatory Framework

The CEQ regulations implementing NEPA state that when economic or social effects and natural or physical environmental effects are interrelated, the EIS would discuss these effects on the human environment (40 CFR § 1508.14). The CEQ regulations further state that the "human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment." In addition, 40 CFR § 1508.8 states that agencies need to assess not only direct effects, but also "aesthetic, historic, cultural, economic, social, or health" effects. Following from these CEQ regulations, the socioeconomic analysis in this SEIS evaluates how elements of the human environment such as population, employment, housing, and public services might be affected by the proposed action.

3.15.3 Approach to Analysis

3.15.3.1 Methodology

The methodology for assessing socioeconomics impacts varies for different socioeconomic resources and is summarized briefly in this section. The SIAS in Appendix D contains more details regarding the different methodologies used.

Methods for Population Sections

Direct DoD population includes the number of active-duty personnel and civil-service government employees (and their respective dependents) that would in-migrate to Guam under the proposed action. This component of the proposed action is consistent for all cantonment alternatives. Data used to derive direct DoD population estimates are based on information provided by the DoD. The remaining project-related population is based on economic modeling of the expected increase in non-direct DoD jobs, including part-time jobs. In order to equate the number of jobs to a number of persons, jobs are converted into full time equivalent (FTE) units, so that one FTE job equals one person. A population growth estimation procedure was used to forecast the number of people that would in-migrate to Guam to fill the new FTE jobs, as well as the dependents that would accompany them.

The characteristics of the in-migrating population to Guam were also projected. These projections in turn fed into projections of the demographic and household impacts of the proposed action. Demographic and household characteristics are presented comparatively, meaning that characteristics of the new population

are compared to the existing population, and the impact is presented as the change in characteristics resulting from implementation of the proposed action.

Methods for Economic Sections

"Economic Impacts" primarily include topics where numerical estimates can be made, including:

- Civilian employment and income
- Housing for civilian population
- Government revenues and sources
- Gross Island Product (GIP)

Some economic topics are less conducive to quantification, so qualitative information about potential impacts is also presented for the following:

- Potential effects on standard of living
- Unemployment
- Local business opportunities and constraints
- Effects on tourism

The Impact Analysis for Planning (IMPLAN) Model (Minnesota IMPLAN Group Inc. 2013) was used in conjunction with input provided by DoD for measurement of economic impacts related to both construction (relatively short-term) and operational (relatively long-term) phases of the proposed action. IMPLAN is maintained and licensed by the Minnesota IMPLAN Group Inc. It is widely used by economists to assess the direct and indirect impacts of economic activities on local and regional economies. In addition to providing estimates of a "multiplier effect" (which measure how the initial influence of a direct impact is multiplied as it ripples through the economy), IMPLAN contains a detailed database which makes it possible to estimate the direct jobs and incomes associated with any given dollar amount of vendor purchases. The model uses "Social Accounting Matrix" multipliers with the amount of recycled (i.e., "multiplier"-related) spending limited to private sector spending. The IMPLAN model generates various outputs (economic output including value added, labor income, and employment) and provides specific detail on the nature of those outputs - whether the impacts are direct, indirect, or induced.

Because there is no economic model specifically tailored for Guam, the IMPLAN model was fitted with year 2010 data for Honolulu County, Hawaii and then modified internally - using factors gathered in published data and interviews with Guam sources - to represent the Guam economy. While Honolulu County has a larger and more diversified economy than Guam, the two places match up well in a structural capacity as both are economic hubs for island chains, and both are places where tourism and military activity are important industries. Guam and Honolulu County have both experienced high levels of construction activity and have construction equipment available on-island, which is an important factor for estimating the economic impacts of construction. Also, Guam and Honolulu County are similar in that they are banking centers. Guam has its own local banks and it is the center for banking in the Mariana Islands. Honolulu County also has its own local banks and it is the center for banking in the Hawaiian Islands. This similarity is important as the banking system is a facilitator of intra-industry commerce, which is a major underlying factor in capturing accurate multiplier effects.

Adjustments to the Honolulu County model were made to compensate for Honolulu's larger size and more diversified economy. Industry compositions were compared and where the IMPLAN model included industries present in Honolulu County that are not present in Guam, those industries were

removed from the model so that they would not contribute to intra-industry expenditures or multiplier effects. With the IMPLAN model adjusted to represent the Guam economy, spending associated with the proposed action that would stimulate the Guam economy and generate economic activity versus spending that would "leak" off-island or never reach the island at all could be accounted for.

The analysis also included broad estimates of GovGuam tax revenues. These estimates stem from economic modeling results of value added and labor income. Value added results served as the tax base for Gross Receipts Tax and Corporate Income Tax revenue analysis. Civilian labor income estimates (along with direct military pay) served as the tax base for income tax revenue analysis.

Housing demand and supply analysis was conducted to assess whether demand within Guam's private-sector housing market would be affected by in-migrating civilian populations during construction and operation of the proposed action, exclusive of active duty military and their dependents (who are assumed to live in the main cantonment) and foreign national construction workers granted H-2B visas. Civilian housing demand impacts are based on population impacts. The total population impacts are divided by an estimated (based on U.S. Census data) number of persons per household, yielding the estimated number of new housing units required. If there is an on-island shortage of housing units needed to meet the projected demand associated with the proposed action, then additional housing units would be required. In the case of a housing shortfall, the island economy would either generate housing that may remain vacant thereafter, or the disincentives for such short-term housing production could result in a shortage of housing during the construction period.

Analyses for other economic topics (standard of living, unemployment, business opportunities and constraints, and effects on tourism) are presented, for the most part, qualitatively. In some cases published data or results derived from the economic model were used as a basis for analysis. In most cases, however, data used to develop these analyses were qualitative, based on in-person interviews conducted for the SIAS (Appendix D).

Methods for Public Service Sections

Impacts on GovGuam public service agencies were estimated based on information from literature reviews, searches of online and historical data sources, written questionnaires, key informant interviews, and published agency data when available.

The basic method of analysis involved first determining the number of key professional staff currently working at each agency, these most recent staffing data are presented in the affected environment section. In addition to presenting the most recent data in the affected environment section, appropriate baseline measures were determined by applying historical data from the agencies, which minimizes the likelihood that the most recent available figures might be derived from years with unusually high or low standards of service. In most cases, staffing data provided by agencies during the 2013 data gathering for the SIAS was based on data from the year 2010. Then the number of each agency's "service population" (i.e., the people using the services) was determined, and care was taken to determine whether this meant the population in general or just some portion, such as civilians only or children only. Finally, these two numbers were used to develop an agency-specific ratio of key professional staff positions to service population.

Once the above calculations were completed, population increases associated with the proposed action could be applied to the ratios to determine the additional professional staff requirements that would be associated with the proposed action. Potential increases in the need for professional staff were calculated for agencies that would see an increase in demand from service populations, as well as growth-permitting

agencies that would see an increase in demand from increased development and permitting activities. While the results of analysis indicate the anticipated required number of additional staff, it is not anticipated that all of those requirements would be met. This is because it is not anticipated that hiring would occur quick enough to meet rising employment demand so, as employment demand declines, there would not necessarily be layoffs to the extent that analysis may imply.

Methods for Sociocultural Sections

Sociocultural topics are addressed in a qualitative fashion. The analysis used available evidence from published sources, interviews, and historical data. Some social issues could have many outcomes and are more important to manage than to predict. There are also pre-existing social issues that, due to the nature of the proposed action, may be more often discussed or remembered by Guam's residents. Issues such as these were discussed in the affected environment section of the 2010 Final EIS (Volume 2, Chapter 16: Socioeconomics and General Services, Section 16.1.6: Sociocultural Issues, pages 16-32 to 16-39).

The analysis of sociocultural issues focused on the following topics:

- Crime and social order.
- Political and Chamorro issues.
- Community cohesion.

Methods for Land Acquisition Sections

The analysis of land acquisition impacts focuses on the potential economic and sociocultural effects of an increase in federally controlled land on Guam. Land acquisition analysis differs from the analysis of other socioeconomic resources because the potential impacts are specific to each action alternative. Though no land acquisition is proposed for the cantonment/family housing alternatives, four of the five LFTRC alternatives would involve land acquisition.

The impact assessment is divided into two sections, an economic impact section and a sociocultural impact section. Within those two sections the potential impacts on the following stakeholders are assessed:

Individual Owner/Occupants: defined as directly affected landowners, claimants, and tenants (including lessees and licensees) whose lots would be potentially acquired due to the proposed action.

Community: defined as members of the Guam island-wide community who might be impacted by the proposed land acquisition. There are concerns that the community immediately surrounding the parcels to be acquired would be impacted more significantly than the general Guam community, but the focus of impact assessment is on the entire Guam community.

GovGuam: defined as a large landowner who leases property and maintains properties in trust or for the benefit of the larger community. While the potential impacts of land acquisition could be discussed under either the construction or operations phases of the proposed action, for this SEIS analysis they are considered operational long-term impacts.

3.15.3.2 Impact Assessment Criteria

Significance determination criteria vary among different types of socioeconomic impacts, because what might be beneficial to one entity could be adverse to another, or the impacts could be mixed (i.e., elements that are both beneficial and adverse). For example, increased job opportunities generated by a project may be considered beneficial, while potential social stress from in-migrant workers attracted by the new job opportunities may be considered an adverse impact.

The CEQ regulations for implementing NEPA provide broad guidelines for determining whether impacts are considered significant based on intensity and/or the context of existing socioeconomic conditions. None of the guidelines are specific to socioeconomic topics, but some of the guidelines refer to the "public" or the "human environment" rather than physical resources or places. CEQ guidelines contribute to the following formulations of impact assessment criteria.

Criteria for Population/Economic Sections

Although there is no national legislation that establishes criteria for assessing socioeconomic impacts, there are DoD-specific legislation (Public Law 110-17 10 USC 2391: Military base reuse studies and community planning assistance) and implementing DoD Directives (DoD 3030.01 and 5410.12) that address the issue of what is a significant impact on communities due to changes in DoD programs, such as a military base realignment or expansion. Collectively, these documents establish "thresholds" that allow the DoD's OEA to provide communities with technical and financial assistance for organizing and planning for DoD program impacts. To qualify for financial assistance, the magnitude of DoD personnel increases must meet the following statutory thresholds:

- More than 2,000 direct military, civilian, and contractor DoD personnel (i.e., net additional).
- More military, civilian and contractor personnel than equal to 10% of the number of persons employed in the counties or independent municipalities within 15 miles (24 km) of the installation, whichever is less.
- Federal, state, or local community impact planning assistance is not otherwise available.

Additionally, the OEA must make a finding that the affected community would experience a "direct and significantly adverse consequence" based on the DoD impacts in light of community-specific needs and resources (Economic Adjustment Technical Bulletin 5: Managing Community Growth).

The above thresholds are population/economic and capacity-driven and they have been applied by the OEA to make financial grants to GovGuam.

The Population/Economic analysis in this SEIS focuses primarily on the impact the proposed action would have on the economy of Guam and the prosperity of its people. Given that the OEA threshold criteria have already been met, for purposes of this analysis, any population or economic impact was considered "significant" if it would add 2% or more at any point in time to expected population or economic levels without the proposed action. The literature on growth rates that communities can absorb without experiencing serious consequences to their physical and social infrastructure and fiscal health does not provide an absolute threshold. Rather, the literature points to the relative abilities of communities to absorb growth based on their existing capacities and contextual settings. The threshold value of 2% was selected for purposes of this SEIS because of the small size and remoteness of Guam's economy and its relatively limited financial resources. Another value often used for statistical comparisons is 5%, but this threshold of significance was deemed too stringent for Guam given existing constraints on Guam's infrastructure capacity and financial situation.

Quantifiable impacts related to jobs and dollars - the usual measures of economic prosperity - were considered "beneficial" impacts if implementation of the proposed action increased the level of jobs or dollars by 2% or more. While there is the potential for an economic downturn after the construction boom peak has occurred, the overall positive economic impact to Guam resulting from the proposed action would still yield steady-state "beneficial" effects even if an economic downturn were to occur after construction was completed.

Impacts that are either qualitative (such as effects on tourism) or where precise numbers cannot be predicted (such as cost of living) were given significance ratings on a judgmental basis considering the overall information available from surveys or interviews conducted as part of this study. In some cases the results of these efforts were too mixed in nature to be clearly called either a beneficial or an adverse impact.

Population increases in particular were considered as inherently mixed (both beneficial and adverse), because population growth fuels economic expansion, but sudden growth also strains government services and the social fabric.

Criteria for Public Services Sections

The Public Services analysis focused on the impacts of the proposed action to GovGuam public services and permitting agencies. Public services agencies affected by increased population were grouped according to the category of services provided (e.g., education, health, and public safety) and the permitting agencies affected by increases in development were evaluated as a single group. The potential impact to each agency was characterized in terms of the proportional increase in staffing requirement that would result (both directly and indirectly) from the project-related increase in either island population or the amount of development.

The significance of the staffing level impacts was evaluated both quantitatively and qualitatively, at the agency group and the individual agency level. Individual agency staffing impacts were aggregated by agency groups and the resulting total percentage staffing impact for each group was used as a screening mechanism to identify agency groups with a generally higher level of impact. A total or group-level increase of 2% above baseline staffing for the group was used to screen out the higher impact groups for closer evaluation. The staffing impacts on the individual agencies within such groups was then scrutinized more closely, taking into account not only the percentage increase in required staffing, but also the unique circumstances and context that influence how each agency would really be affected by the increase. For example, on a percentage basis, there could be a greater requirement for nurses than police officers. However, given the additional context that Guam's capacity to train skilled nurses has recently increased due to programs at Guam Community College (GCC) in the new Allied Health Building, and that the Guam Police Department (GPD) has identified critical existing deficits in equipment and staff along with problems with employee retention, the impact to public safety agencies might be considered significant while the impacts to public health agencies might be considered less than significant. The percentage increase by itself is not sufficient to justify a significance determination without also evaluating reasonable contextual factors.

Also, temporal considerations were included as qualifiers of significance - significant impacts were qualified as either short-term (occurring for a few years during the construction phase) or long-term (occurring over the steady-state operational period). Because the construction period and the operational period would overlap for a few years, short-term impacts coincide with maximum impacts (i.e., the highest level of impacts would be short-term while lower levels of impacts would be the norm in the long-term). In terms of increased staffing requirements, this may mean (for example) that an agency would require 20 additional staff during the construction phase but a more manageable 2 additional staff in steady-state operations. So, in many cases, impacts were determined to be significant in the short-term but less than significant in the long-term.

This approach to determining significance differs from the fixed threshold criterion that was used in the 2010 Final EIS. The 2010 Final EIS applied a strict quantitative threshold of a 2% or higher increase in staffing to determine significance, regardless of any other circumstances or context. While percentage

increases in staffing required were considered in this SEIS analysis, and the 2% level was used to initially screen agency groups for closer evaluation, the additional contextual information that was considered in the impact assessment (e.g., existing agency deficits, capacity going forward, and temporal considerations) is more reasonable and less arbitrary than using a uniform quantitative threshold without real-world context.

Criteria for Sociocultural Sections

Sociocultural impacts are largely qualitative in nature, and the analysis focused less on predicting quantifiable impacts than on identifying potential problems and opportunities. However, sociocultural impacts remain an important element of the proposed action and have attracted much public attention and comment. Many sociocultural impacts tend to be mixed in nature. To the extent their "significance" can be assessed, it was based on the relative magnitude of the proposed action under consideration. They were regarded as "adverse" if they threatened public safety or order, and "beneficial" if they preserved or enhanced the social fabric.

Criteria for Land Acquisition Sections

Economic Significance

There would be no economic impact to individual landowners when the federal government acquires land under the Uniform Act. The Uniform Act provides for just compensation under either negotiated purchase (as there is an agreed upon price) or eminent domain (as the payment for land is determined by a federal court). Furthermore, the Uniform Act prescribes full compensation for improvements to land and relocation costs for occupants of land. The 5th amendment of the U.S. Constitution guarantees the provision of "just compensation" to landowners and occupants of land when the government takes land from private hands for public use.

Economic impacts to the community would occur if land acquisition were to affect the viability of Guam to achieve a self-sustaining economy (discussed in terms of equity value of private land and capacity for agricultural production), and the ability of the community to choose recreational areas to frequent. Economic impacts to GovGuam would occur if land acquisition were to affect the government's ability to collect taxes and garner revenue from real property on the island.

The significance of these impacts is determined through a consideration of the magnitude of the economic value of these impacts relative to these same economic factors Guam-wide. More detailed information regarding the approach to land acquisition impact assessment and significance determinations can be found in the SIAS, Appendix D.

Sociocultural Significance

Regardless of the type of land acquisition adopted (lease, purchase, other), acquisition would require any tenants or current occupants on the land to relocate. There may be some tenants or licensees who are interested in relocating or do not mind relocating, and would perceive the federal acquisition or lease of the property they currently occupy as beneficial. Others who do not want to relocate are likely to consider forced relocation as an adverse impact even though they would be compensated.

Because specific parcels of land may represent patterns of social organization and interpersonal ties to a landowner, user or occupant, land acquisition may cause scattering of social networks, kinship groups and other social resources available to the individual (i.e., a phenomenon known as "social disarticulation" may occur). Cultural marginalization may be experienced within the Guam community due to land acquisition, and would center on cultural site access and the maintenance of the integrity or intrinsic

characteristics of a cultural property. If public access to cultural sites is restricted, or project actions disturb the characteristics of a cultural property that make them culturally important, then the proposed action would have an adverse impact on the community's cultural cohesion under NEPA.

Finally, the taking of land by the federal government from an unwilling seller would be considered an adverse sociocultural impact on the entities that are losing ownership or control of their property. "Taking property" in this discussion refers to a situation where the property owner is legally required to sell property to the federal government.

The significance of these impacts is determined through a consideration of the magnitude of these potential impacts to individuals as well as the Guam-wide community and is influenced by the DON's adherence to federal regulations, most notably the Uniform Relocation Assistance and Real Property Acquisition Policies for Federal and Federally Assisted Programs Act of 1970, as amended (Uniform Act), and as enacted through Public Law 91-646, which provides minimum standards of performance for all federally funded projects that require the acquisition of real property, including the relocation of persons displaced by such acquisition.

3.15.3.3 Public Scoping Issues

During the scoping process, a variety of socioeconomic concerns were expressed by both local residents and by GovGuam. Additionally, these issues have been stressed in studies and publications released by GovGuam and covered in the public media on Guam. The three most common concerns expressed through the scoping process included the economy (20%), cultural identity (19%), and population growth (18%). More generally, concerns identified during the scoping period included:

- *Economics:* References to potential impacts to the economy.
- *Tourism:* References to potential impacts to the tourism sector.
- *Crime:* References to potential rise in crime rate.
- *Cultural Identity:* References to the people and Chamorro culture of Guam.
- *Infrastructure:* References to potential impacts to the existing infrastructure of Guam.
- *Population Growth:* References to increased population associated with the proposed action and alternatives.
- *Guam Self Determination:* References to Guam and its citizens having the right to determine the future of Guam.
- *Public Services:* References to potential impacts to existing public services.
- *Land Acquisition:* The general consensus was that the DON should look at all possible alternatives within its own land before it considers the use of public and private lands. Public scoping comments indicated that a number of Guam residents are not supportive of an increase in federally owned or controlled land on Guam, and considered the increase an adverse impact. Furthermore, comments did not support further access restrictions to recreational and cultural resources on island as a result of military development.

3.16 HAZARDOUS MATERIALS AND WASTE

3.16.1 Definition

The analysis of hazardous materials, hazardous waste, toxic substances, and contaminated sites focuses on the potential for these substances to be introduced into the environment during construction/demolition or from operations and maintenance activities. A comprehensive description of hazardous materials and

waste on Guam is provided in the 2010 Final EIS (Volume 2, Chapter 17: Hazardous Materials and Waste, Section 17.1: Affected Environment, pages 17-1 to 17-11). This SEIS includes any relevant hazardous material and waste information that may have changed or been updated since the 2010 Final EIS was completed.

3.16.2 Regulatory Framework

DoD installations are required to comply with all applicable federal, territorial (e.g., GEPA), and DoD laws and regulations and EOs with regards to hazardous materials and waste. For the purposes of this SEIS, phrases such as hazardous material, hazardous waste, and toxic substances are defined in the same manner as the 2010 Final EIS (Volume 2, Chapter 17: Hazardous Materials and Waste, Section 17.1: Affected Environment, pages 17-1 to 17-7). The regulatory framework that pertains to the use, storage, transport, handling and disposal of these materials, waste and substances is also the same as described in the above referenced section of the 2010 Final EIS.

3.16.3 Approach to Analysis

3.16.3.1 Methodology

Potential impacts related to hazardous materials, hazardous waste, and toxic substances were evaluated by assessing impacts of the proposed action on the procedures, policies, plans, and infrastructure required to safely and responsibly store, dispense, handle, and dispose of additional hazardous materials, toxic substances, and/or hazardous waste. The methodology for assessing impacts from hazardous waste also considered the likelihood of generating and encountering hazardous waste during construction by considering the use of substances such as fuels, paints, and solvents during the construction phase as well as by comparing the proximity of proposed facility development to known contaminated sites or buildings proposed for demolition. For purposes of this analysis, contaminated sites that could result in conditions indicative of releases or threatened releases of hazardous substances (i.e., groundwater contamination) were also considered. In addition, the analysis considered potential operational impacts (i.e., using more hazardous materials and generating more hazardous waste that would each need proper handling, storage, and documentation once the proposed action is in the operations phase of implementation).

3.16.3.2 Impact Assessment Criteria

Factors considered in the analysis include the potential for increased human health risk or environmental exposure, as well as changes in the quantity and types of hazardous substances transported, stored, used, and disposed.

The determination of significance is based upon existing hazardous substance management practices, expected or potential impacts of the proposed action and alternatives, and potential mitigation measures to reduce the severity of impacts. This determination evaluated the overall ability to manage or control hazardous materials and waste impacts and consequences to soils, surface water, groundwater, air, and biota. This determination considers current conditions and potential consequences relative to the anticipated ability of the hazardous substance management infrastructure to accommodate added hazardous substance demands on the overall system. Specifically, for hazardous substances to be considered a significant impact, the following would have to occur:

- Leaks, spills, or releases of hazardous substances to environmental media (i.e., soils, surface water, groundwater, air, and/or biota) resulting in unacceptable risks to human health or the environment.

- Violation of applicable federal, state, or local laws or regulations regarding the transportation, storage, handling, use, or disposal of hazardous substances.

3.16.3.3 Public Scoping Issues

The scoping comments/concerns regarding hazardous materials and waste are summarized as follows:

- Range management and housekeeping practices.
- Lead management and mitigation at training ranges.
- Use of depleted uranium during live-fire training exercises.
- Erosion control at ranges.
- Lead impacts to surface waters from leaching and erosion of range soils.
- Changes in hazardous waste generation and type.
- Hazardous waste minimization and mitigation methods.
- Hazardous material/waste spill prevention and control.

3.17 PUBLIC HEALTH AND SAFETY

3.17.1 Definition

Public health and safety issues pertinent to Guam are described in the 2010 Final EIS (Volume 2, Chapter 18: Public Health and Safety, Section 18.1: Affected Environment, pages 18-1 to 18-12). This SEIS includes any relevant public health and safety information that may have changed or been updated since the 2010 Final EIS was completed.

Public health and safety issues include operational safety, environmental health effects, notifiable diseases, mental illness, hazardous substances, unexploded ordnance (UXO), and traffic incidents. Notifiable diseases are diseases that are required by law to be reported to government authorities (i.e., cholera, dengue, hepatitis C, malaria, measles, rubella, typhoid fever, tuberculosis, Acquired Immune Deficiency Syndrome [AIDS], and sexually transmitted diseases [STDs]). This collation of information allows authorities to monitor the disease and provides early warning of possible outbreaks. Mental illness includes various psychiatric conditions that cause impairment of an individual's behavior. Unexploded military munitions include ordnance items that were fired from a weapon and failed to function properly or munitions that were not fired but abandoned and were not properly disposed. A traffic incident is a road traffic incident that usually involves one automobile (e.g., car, truck, motorcycle) colliding with either another vehicle or a stationary roadside object. Additional detail regarding DON and Marine Corps safety standards, explosive safety standards, and electromagnetic emissions safety is provided below. The ROI for public health and safety concerns includes the entire island for concerns related to notifiable diseases. The ROI for concerns related to operational safety, environmental health effects (i.e., noise and water quality), hazardous substances, UXO, and transportation is focused on the locations of the proposed cantonment and family housing alternatives (see Chapter 4 of this SEIS) and the proposed LFTRC alternatives (see Chapter 5 of this SEIS).

3.17.1.1 Range Activities

As outlined in the documents developed by the Office of the Chief of Naval Operations (OPNAVINST 3500.39A) and the Marine Corps (MCO 3500.27A), Operational Risk Management is employed at training ranges to identify and assess hazards and implement controls for all phases of training events.

For live-fire training ranges, a containment area is established to ensure live-fire training is contained by SDZs developed for the range. SDZs are prepared to determine the restricted land and airspace requirements to laterally and vertically contain projectiles, fragments, debris, and components resulting from the firing of weapons. A composite SDZ provides a summation of acceptable individual SDZs for a particular range and defines the minimum land and airspace areas needed for safe live-fire training associated with applicable weapons.

Noise

Potential impacts on public health and safety from increased noise can be indirect or direct, short or long-term, or permanent. These impacts are a function of intensity and duration of noise. Indirect impacts on humans from noise can include annoyance, speech interference, difficulty concentrating, reduced efficiency, low morale, and adverse social behavior (Occupational Safety and Health Administration [OSHA] 2009).

The primary direct impacts of excessive noise exposure on public health and safety may include:

- *Acoustic trauma,* a temporary or permanent hearing loss caused by a sudden, intense acoustic or noise event (i.e., an explosion).
- *Tinnitus,* a condition of "ringing in the ears." The predominant cause of tinnitus is long-term exposure to high sound levels, though it can also be caused by short-term exposure to very high sound levels, such as gunshots. Many people experience tinnitus during their lives. Although the sensation often is only temporary, it can be permanent and debilitating.
- *Noise-induced temporary threshold shift* is a temporary loss in hearing sensitivity. This condition may be the result of the acoustic reflex of the stapedial muscle; short-term exposure to noise; or fatigue of the inner ear. Hearing sensitivity may return to the pre-exposed level in a matter of hours or days, assuming that no continued exposure to excessive noise occurs.
- *Noise-induced permanent threshold shift* is a permanent loss in hearing sensitivity caused by the destruction of sensory cells in the inner ear. This condition can be caused by long-term exposure to noise, or acoustic trauma.

Explosives Safety

Siting requirements for explosive materials storage (e.g., munitions) and handling facilities are based on safety and security criteria established by the DoD Explosive Safety Board. ESQD arcs determine the distance between ordnance storage and handling facilities and inhabitable areas. Ammunition and bulk explosives are stored in magazines specifically designed, sited, and designated for this purpose. A magazine's ESQD arc is calculated by the type and amount of ordnance stored in that magazine. ESQD requirements and permissible storage capacities are established by Naval Sea Systems Command and approved by the DoD Explosives Safety Board.

Unexploded military munitions can be classified into two main categories: UXO and discarded military munitions (DMM). UXO includes ordnance items that were fired from a weapon and failed to function properly (i.e., explode). These items are fused and are considered more sensitive than DMM. DMM includes munitions that were not fired but abandoned and were not properly disposed. DMM items could include munitions that were left behind by military personnel and intentionally buried (i.e., weapons cache) or unintentionally buried as a result of combat on the island. Additionally, the retaking of Guam by Allied/American forces required amphibious landings. Therefore, UXO and DMM may also be present in waters off the assault beaches.

UXO and DMM items include, but are not limited to aerial bombs, Naval and field artillery projectiles, aerial and barrage rockets, mortar rounds, bazooka rounds, hand grenades, landmines, flares, and other pyrotechnic devices. The aforementioned munitions vary in size (e.g., 105-mm or 5-inch projectiles) and explosive hazard (e.g., high explosive, incendiary filler).

Clearances for unexploded military munitions have been conducted in the past to remove this hazard, and unexploded military munitions have been found and reported periodically since the end of WWII. Although almost 70 years have passed since the battle for Guam and portions of the island have been developed, unexploded military munitions may still be present.

In accordance with Naval Ordnance Safety and Security Activity Instruction 8020.15D, Explosives Safety Submission (ESS) documentation must be prepared that details how explosive safety standards are applied to munitions responses. The ESS also addresses how a project would comply with applicable environmental requirements related to the management of munitions and explosives of concern (MEC) and material potentially presenting an explosive hazard (MPPEH). At munitions response sites, no site operations may begin unless Naval Ordnance Safety and Security Activity and the DoD Explosive Safety Board have reviewed and approved the ESS. Preparation of an ESS is required when conducting ground-disturbing or other intrusive activities in areas known or suspected to contain MEC and/or MPPEH. The ESS outlines specific measures to be taken to ensure the safety of workers and the public. ESS documentation has been prepared for activities proposed on Guam.

Electromagnetic Emissions

Radar and other high-energy electromagnetic emissions can constitute a hazard to persons exposed to radiation above a threshold power density. Electromagnetic signals emanating from communication and other radar equipment can also interfere with and adversely affect stored ordnance and fuel. Electromagnetic radiation hazards occur when transmitting equipment generates sufficient field intensity to cause harmful or injurious effects to humans or wildlife; induce or couple currents and/or voltages of magnitudes sufficient to initiate electro-explosive devices in ordnance; or create sparks of sufficient magnitude to ignite flammable materials.

Exposure to electromagnetic emissions is controlled in accordance with national exposure standards (e.g., federal and voluntary exposure standards), which are set by experts in biophysics, medicine, engineering, and epidemiology. The Institute of Electrical and Electronics Engineers International Committee for Electromagnetic Safety produces an electromagnetic emission standard that has been adopted by the American National Standards Institute as an Institute of Electrical and Electronics Engineers/American National Standards Institute standard. This voluntary standard is based on numerous sources of scientific information that are subject to rigorous review. After reviewing the biological effects database, scientific committees concluded that the threshold for potential adverse biological effects was 4 watts per kg of absorbed electromagnetic emission per unit mass of tissue. The standards-making organizations have adopted safety factors for electromagnetic emission exposures in occupational and general public settings. These safety factors are set at 10 for occupational exposures and 50 for general public exposures, thereby reducing the adverse biological effects threshold to 0.4 and 0.08 watts per kg, respectively (Institute of Electrical and Electronics Engineers 1999).

3.17.2 Regulatory Framework

The Marine Corps practices Operational Risk Management as outlined in the OPNAVINST 3500.39A and MCO 3500.27A. Requirements outlined in these documents provide for a process to maintain readiness in peacetime and achieve success in combat while safeguarding people and resources. The

health and safety analysis presented in the following sections addresses issues related to the health and well-being of both military personnel and civilians living on Guam in the vicinity of proposed military operations and training areas.

The Guam Department of Public Health and Social Services (GDPHSS) ensures construction and daily activities on Guam are conducted in accordance with applicable federal and Guam laws and regulations to ensure a safe working and living environment for Guam residents to live and work.

The USEPA and GEPA enforce Safe Drinking Water Act standards and related legislation to protect public health. Currently, Guam's water quality meets Safe Drinking Water Act standards.

3.17.3 Approach to Analysis

3.17.3.1 Methodology

Public health and safety concerns were addressed based on anticipated changes in the population of Guam, both from natural increases and from population growth created by implementing the proposed alternatives for cantonment/family housing and the LFTRC. Average per capita incidents for notifiable diseases, mental illness, and traffic incidents were used to calculate the potential increase in these incidents as a result of the alternatives. Safety of construction workers would be conducted in accordance with Occupational Safety and Health Administration guidelines to ensure a safe work environment.

Data used for the analysis included information regarding the current and projected population of Guam as well as incident rates for notifiable diseases, mental illness, and traffic accidents. Population, notifiable disease, mental illness, and traffic accident data were obtained from various sources including the Guam Bureau of Statistics and the Bureau of the Census. Information regarding the possible presence of UXO was obtained from various military and public sources. Operation safety information specific to the proposed movement of Marines to Guam was obtained from military sources (see Chapter 9, References, of this SEIS). Impacts due to environmental effects related to the proposed action were derived from appropriate chapters of this SEIS. These include water resources, noise, and hazardous materials and waste.

3.17.3.2 Impact Assessment Criteria

Factors considered in determining whether an alternative would have a significant public safety impact include the extent or degree to which implementation of the alternative would subject the public to increased risk of contracting a disease or experiencing personal injury. For proposed military events conducted on Guam, specific and documented procedures are in place to ensure that the public is not endangered by military operations and training activities.

3.17.3.3 Public Scoping Issues

The scoping comments/concerns regarding public health and safety are summarized as follows:

- Airborne toxic dust.
- Potential contamination of the Fena Valley Reservoir.
- Physical safety of the public with live ammunition in close proximity to villages.
- Potential impact on health of residents from increased stress due to increased noise levels.

3.18 ENVIRONMENTAL JUSTICE AND THE PROTECTION OF CHILDREN

3.18.1 Definition

The definition of this resource area is unchanged from the 2010 Final EIS (Volume 2, Chapter 19: Environmental Justice and the Protection of Children, Section 19.1.1 Definition of Resource, pages 19-1 to 19-4). Briefly summarized, EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires federal agencies to assess the potential for their actions to have disproportionately high and adverse environmental and health impacts on minority and low-income populations. In 1997, EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, required a similar analysis for children, where federal agencies must identify and assess environmental health risks and safety risks that may disproportionately affect children.

EO 12898 authorized the creation of an Interagency Working Group on Environmental Justice, overseen by the USEPA, to implement the EO's requirements. The Interagency Working Group and the USEPA developed guidance for terms contained in the EO. The USEPA (2013) defines environmental justice as "The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

The following definitions apply to this section and the environmental consequences discussion in this SEIS (Section 4.1.18.2):

- Consistent with CEQ's *Environmental Justice Guidance Under the National Environmental Policy Act* (CEQ 1997), this chapter defines a racial minority according to the definition used in the 2010 U.S. Census: a racial minority includes American Indian or Alaskan Native; Asian; Native Hawaiian and other Pacific Islander; Black or African American; and Hispanic or Latino. The 2010 Census (U.S. Census Bureau 2010a) allowed individuals to choose more than one race. For this analysis, consistent with guidance from the CEQ as well as USEPA (CEQ 1997; USEPA 1998, 1999), "minority" refers to people who are Pacific Islander, as well as those who are non-Pacific Islander of a race other than White alone.
- Also consistent with CEQ guidance (1997), this analysis bases the definition of low income on the official national poverty line according to the U.S. Census (U.S. Census Bureau 2010b) ($22,314 for a family of four).
- Based on U.S. Census 2010 data categories, children are defined as people under the age of 18.

3.18.2 Regulatory Framework

Neither the EO nor the CEQ guidance prescribes a specific format for environmental justice assessments in the context of NEPA documents. However, CEQ (1997) identifies the following six general principles intended to guide the integration of environmental justice assessment into NEPA compliance:

- Agencies should consider the composition of the affected area to determine whether minority populations, low-income populations, or Indian tribes are present in the area affected by the proposed action and, if so, whether there may be disproportionately high and adverse human health or environmental effects on minority populations, low-income populations, or Indian tribes.
- Agencies should consider relevant public health data and industry data concerning the potential for multiple or cumulative exposure to human health or environmental hazards in the affected population and historical patterns of exposure to environmental hazards, to the extent such

information is reasonably available. For example, data may suggest there is disproportionately high and adverse human health or environmental effects on a minority population, low-income population, or Indian tribe from the agency action. Agencies should consider these multiple, or cumulative effects, even if certain effects are not within the control or subject to the discretion of the agency proposing the action.

- Agencies should recognize the interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the agencies proposed action. These factors should include the physical sensitivity of the community or population to particular impacts; the effect of any disruption on the community structure associated with the proposed action; and the nature and degree of impact on the physical and social structure of the community.
- Agencies should develop effective public participation strategies. Agencies should, as appropriate, acknowledge and seek to overcome linguistic, cultural, institutional, geographic, and other barriers to meaningful participation, and should incorporate active outreach to affected groups.
- Agencies should assure meaningful community representation in the process. Agencies should be aware of the diverse constituencies within any particular community when they seek community representation and should endeavor to have complete representation of the community as a whole. Agencies also should be aware that community participation must occur as early as possible if it is to be meaningful.
- Agencies should seek tribal representation in a manner that is consistent with current procedures and protocols between the U.S. and tribal governments, the federal government's trust responsibility to federally recognized tribes, and any treaty rights.

In addition, the DoD prepared a "Strategy on Environmental Justice" in 1995 (DoD 1995), which views the Environmental Justice analysis as integral to NEPA analysis of other resources. The DoD will follow these five principles outlined in the strategy to foster environmental justice:

- Promote partnerships with all stakeholders.
- Identify the impacts of DoD activities on minority and low-income populations.
- Streamline government.
- Improve the day-to-day operations of installations.
- Foster nondiscrimination in DoD programs (DoD 1995).

Provisions of the strategy that relate to the NEPA process include improving data collection, assessing how operations and activities affect local communities, and improving outreach efforts (DoD 1995).

3.18.3 Approach to Analysis

3.18.3.1 Methodology

Chapters 4 through 6 of this SEIS examine and identify the potential impacts that each alternative may have on various resources on Guam. Based on the conclusions reached in each resource chapter, the analysis of environmental justice sought to identify the adverse impacts that would disproportionately affect racial minorities, children, and/or low-income populations, based on the following assumptions:

- With regard to the identification of a minority population that could potentially be affected by impacts from the proposed action - the island of Guam is distinctive in that a majority of the population is considered to have minority status due to the prevalence of Pacific Islanders. Because the majority of Guam's population is identified as a minority group, analysis assumes

that wherever there would be adverse effects resulting from the proposed action, those adverse effects would impact minority populations.

- An impact to environmental justice is not solely determined based on whether a minority population is impacted. Rather, an impact to environmental justice can only be determined when an impact to a minority population is disproportionate. Disproportionality implies that minority populations would be affected more strongly than non-minority populations. Because the proposed action takes place only on Guam, the evaluation of environmental justice is based on whether there are disproportionate adverse effects within the context of alternatives for facility locations on Guam. Because such a large proportion of the population qualifies as a minority population, and all of Guam's villages are determined to be minority status areas, minority populations would not be affected disproportionately, relative to Guam's non-minority populations, by the identified adverse impacts.
- There would not be disproportionate environmental justice effects because every municipality on Guam is categorized as a minority population area. There can be determinations of disproportionate impacts to low-income and child populations if the impact is an island-wide impact driven by population growth, so a determination of significant environmental justice impact to low-income and child populations can be made. A determination of significant environmental justice impact to low-income or child populations is made if the impact to the public service that is geared towards providing assistance specifically to low-income or child populations is determined to be significantly impacted. However, this determination would not be made for location-specific impacts (such as noise emanating from a training range) because each municipality on Guam (excluding Santa Rita) is considered a low-income population area.
- The ROI is defined as the area in which the principal effects arising from implementation of the proposed action are likely to occur. Those who may be affected by the action are often those who reside or otherwise occupy areas immediately adjacent to project areas. The ROI for the proposed action and alternatives with regard to environmental justice impacts is typically the entire island of Guam, except for localized noise impacts to nearby populations.
- Because impacts under the proposed action are related to construction, operations, and associated population growth, impacts to villages could result from a "spillover" effect that extends beyond an installation's boundary line into the surrounding community (for instance, noise impacts from operations).

The analysis involved the application of three tiers of criteria to assess the environmental justice implications for each significant impact identified in the relevant resource chapters. In some cases, if the analysis showed that the requirements for the specific criteria were not met, then a discussion on the next tier would not be required. For instance, if an applicable disadvantaged group would not be disproportionately affected in Tier 2, then a discussion on significant effects under environmental justice would not be warranted.

- Tier 1: Are there any minority, low-income, or children populations that would be impacted?
- Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action?
- Tier 3: Would the disproportionate adverse effects be significant?

3.18.3.2 Impact Assessment Criteria

According to Section 1508.27 of the CEQ Regulations for Implementing NEPA, determining the level of significance of an environmental impact requires that both context and intensity be considered. These are defined in Section 1508.27 as follows:

- "Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant."
- "Intensity. This refers to the severity of the impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:
    - Impacts that may be both beneficial and adverse. A significant effect may exist even if the federal agency believes that on balance the effect would be beneficial.
    - The degree to which the proposed action affects public health or safety.
    - Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
    - The degree to which the effects on the quality of the human environment are highly uncertain or involve unique or unknown risks.
    - The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
    - Whether the action is related to other actions with individually less than significant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
    - The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the NRHP or may cause loss or destruction of significant scientific, cultural, or historical resources.
    - The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined critical under the ESA of 1973.
    - Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment."

This chapter uses these criteria to determine significance for the proposed action in terms of environmental justice.

3.18.3.3 Public Scoping Issues

The scoping comments/concerns regarding environmental justice or the protection of children are summarized as follows:

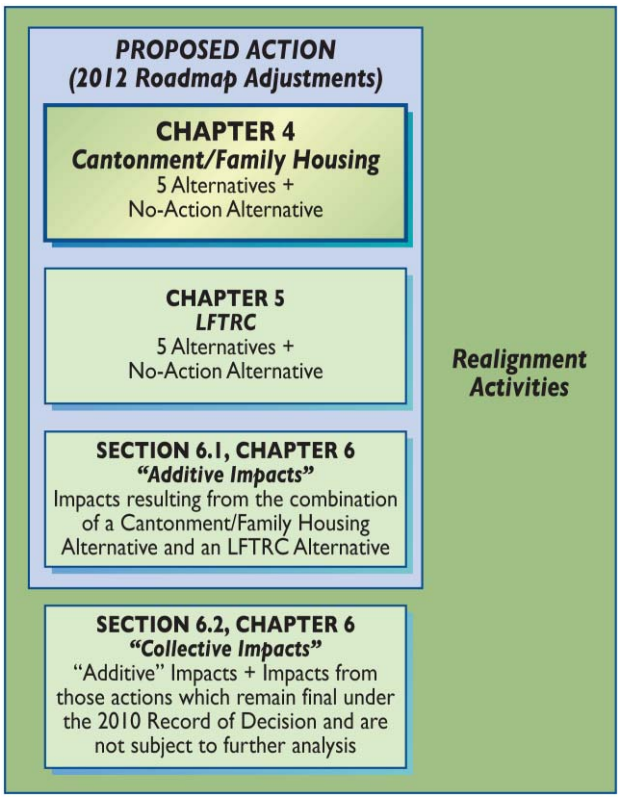
- Questions as to whether infrastructure improvements would benefit Guam residents.
- Concern that the project would create disparity between civilian and military populations.
- Concern about the potential for reduced access to public health and social services.
- Potential for increased traffic congestion to disproportionately impact disadvantaged populations.
- Concern about reduced access to recreational and cultural resources.

- Impacts to utility systems.
- Disproportionate health impacts from degraded air, water, and marine resources on disadvantaged communities and children.
- Impacts to traditional fishing.
- Sociocultural concerns.

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CHAPTER 4
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES AT CANTONMENT/FAMILY HOUSING COMPLEX SITE ALTERNATIVES

This chapter describes the affected environment and potential environmental consequences associated with the cantonment/family housing component of the SEIS proposed action. As shown in the box at right, this is the first of three major sections of this SEIS that analyze the direct and indirect impacts of the 2012 Roadmap Adjustments. The impacts associated with the LFTRC alternatives are addressed in Chapter 5 and the impacts that are unique to specific combinations of a cantonment/family housing alternative and an LFTRC alternative are addressed in Chapter 6.1. When considered in conjunction with the related Marine Corps actions that remain final under the 2010 ROD, as is done in Chapter 6.2, the resulting "collective" impacts represent the total impacts related to the proposed Marine Corps relocation to Guam.



Chapter 4 is structured around each of the five action alternatives for the cantonment/family housing area plus the No-Action Alternative, with associated subsections to address the 18 environmental resource areas that were evaluated for each alternative. The *Affected Environment* subsection for each resource area describes the baseline environmental conditions in the proposed project areas. These baseline conditions provide a comparative framework for evaluating the impacts to each resource, which are presented in the *Environmental Consequences* subsections. In compliance with CEQ regulations implementing NEPA, the environmental consequences discussion includes both direct and indirect impacts. The impact analyses also take into account the implementation of the BMPs included in the proposed action as described in Section 2.8 of this SEIS. At the end of Chapter 4, following the impact analysis for each cantonment/family housing alternative is a table that summarizes the impacts and potential mitigation by alternative for each resource subsection (Table 4.7-1).

Chapter 4: Cantonment/Family Housing

Proposed Action Includes:

- ✓ Relocation of approx. 5,000 Marines and 1,300 dependents to Guam
- ✓ Choice of 5 action alternatives or No-Action:
  - A. Finegayan
  - B. Finegayan/South Finegayan
  - C. Andersen Air Force Base
  - D. Barrigada
  - E. Finegayan/Andersen Air Force Base
- ✓ Onsite and offsite utilities unique to each Alternative
- ✓ Offsite utilities common to all Alternatives
- ✓ Expansion/realignment of 2 DoD schools – same for Alternatives A, B, and D; modified for Alternative C and E

The box at right summarizes the elements of the proposed action for cantonment/family housing that are analyzed in this chapter. These include the relocation of Marine personnel and their

dependents, the construction and operation of the cantonment/family housing area, associated utility infrastructure both on-site and off-site, and renovations at two DoD school sites.

As appropriate to each alternative and each resource area, applicable information from the 2010 Final EIS that remains relevant in the context of this SEIS is incorporated by reference and briefly summarized. Each subsection then places particular emphasis on updating any key resource information that changed since the 2010 Final EIS, and on presenting any new information regarding baseline conditions or environmental consequences that was not included in the 2010 Final EIS.

4.1 FINEGAYAN CANTONMENT/HOUSING - ALTERNATIVE A

Under Alternative A, the proposed development of a cantonment area and family housing would occur at Finegayan. Details about this alternative are provided in Section 2.4.4.1 and the proposed site is illustrated in Figures 2.4-4 and 2.4-5.

4.1.1 Geological and Soil Resources

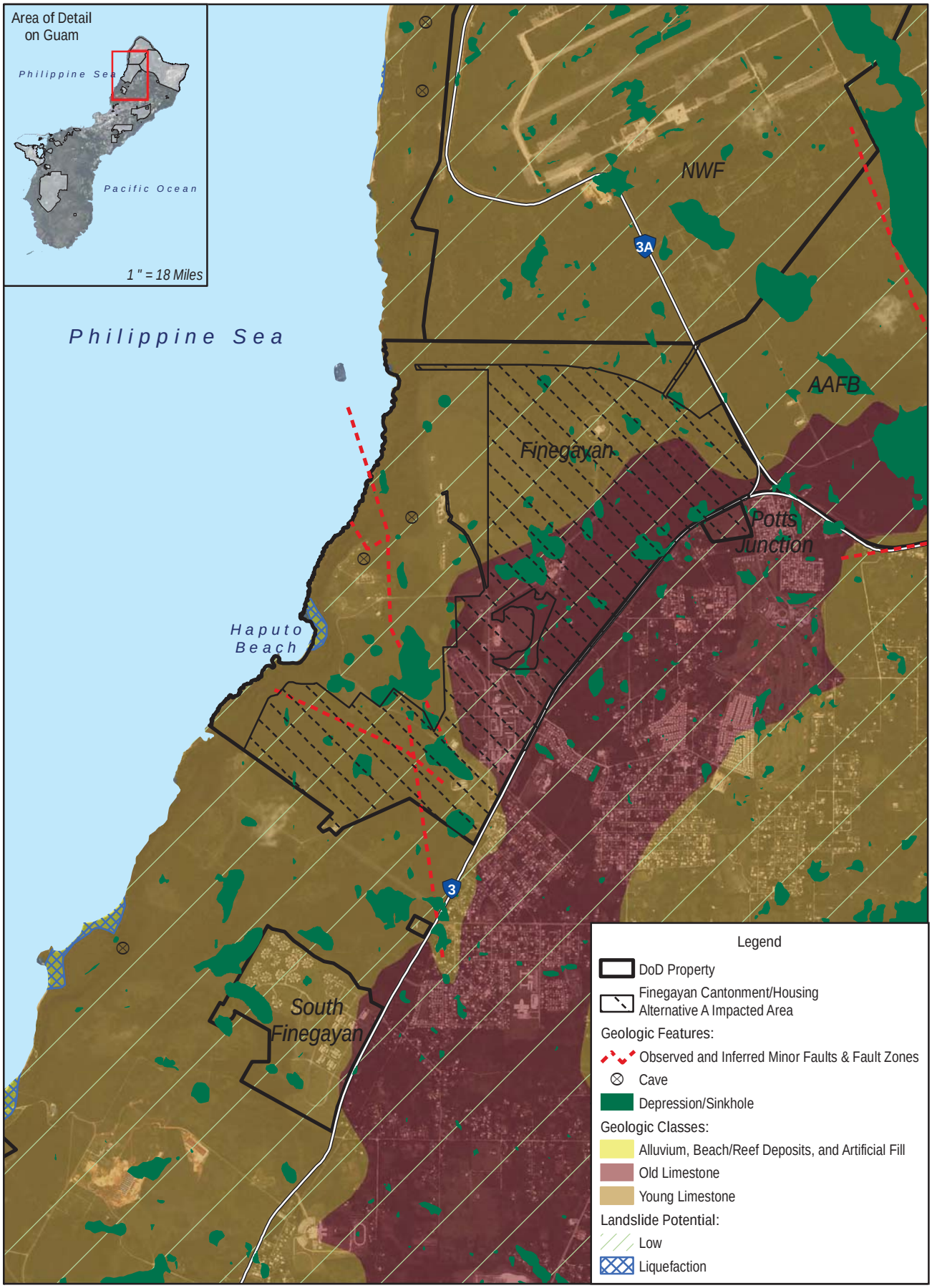
4.1.1.1 Affected Environment

The affected environment for geological and soil resources associated with the Finegayan cantonment/family housing alternative (Alternative A) is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 3: Geology and Soils Resources, Section 3.1.2.2 Finegayan, pages 3-15 to 3-16) which is summarized below for reference. In addition, the geological and soils affected environment for projects common to all alternatives (i.e., school expansions and off-site utilities) would be similar to that described for Finegayan. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for geological and soil resources, but it would reduce some potential impacts to geological and soil resources that were determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, as described in the analysis of environmental consequences for Alternative A below.

The Finegayan project area is located in Guam's northern limestone structural province. Elevations at the top of the limestone plateau range from 500 to 600 feet (152 to 183 m) above mean sea level (MSL) (Figure 4.1.1-1). The ground surface slopes gently downward from northeast to southwest. At the western edge of the plateau, (elevation approximately 200 feet [61 m] MSL) steep cliffs drop to a narrow coastal terrace approximately 100 feet (30 m) MSL. The terrace cliffs and Haputo Beach, located about 1.4 miles (2.2 km) west of Route 3 form the island's coastline west of the proposed Alternative A cantonment site.

Finegayan bedrock consists of old (Barrigada) and young (Mariana) limestone, the geologic setting for sinkholes (see Section 3.1.1.1). Based on available topographic and field data, there are 43 features that have been preliminarily identified as sinkholes/depressions that may contain sinkholes in the Alternative A footprint (Figure 4.1.1-1). A north-south trending fault pattern may control formation of the karst topography.

The majority of the soils at Finegayan are shallow (less than 9 inches [25 cm] deep), well-drained soils (Guam Urban Land Complex and Guam Cobbly Clay Loam) on the limestone plateau (Figure 4.1.1-2) (Young 1988). These soils have a "low" erodibility factor and are not prime farmland as identified by the USDA (Young 1988). Prime farmland soils, as defined by the USDA, are soils best suited to producing food, seed, forage, fiber and oilseed crops, favorable for economic production and sustained high yield, with minimal inputs of energy and resulting in least damage to the environment (Young 1988).



0 0.5 1 Mile

0 0.5 1 Kilometer

Figure 4.1.1-1
Geologic Features in the Vicinity of
Finegayan Cantonment/Housing Alternative A

Sources: COMNAV Marianas 2008; GovGuam 2008; NAVFAC Pacific 2013; Taborosi 2004; WERI 2001

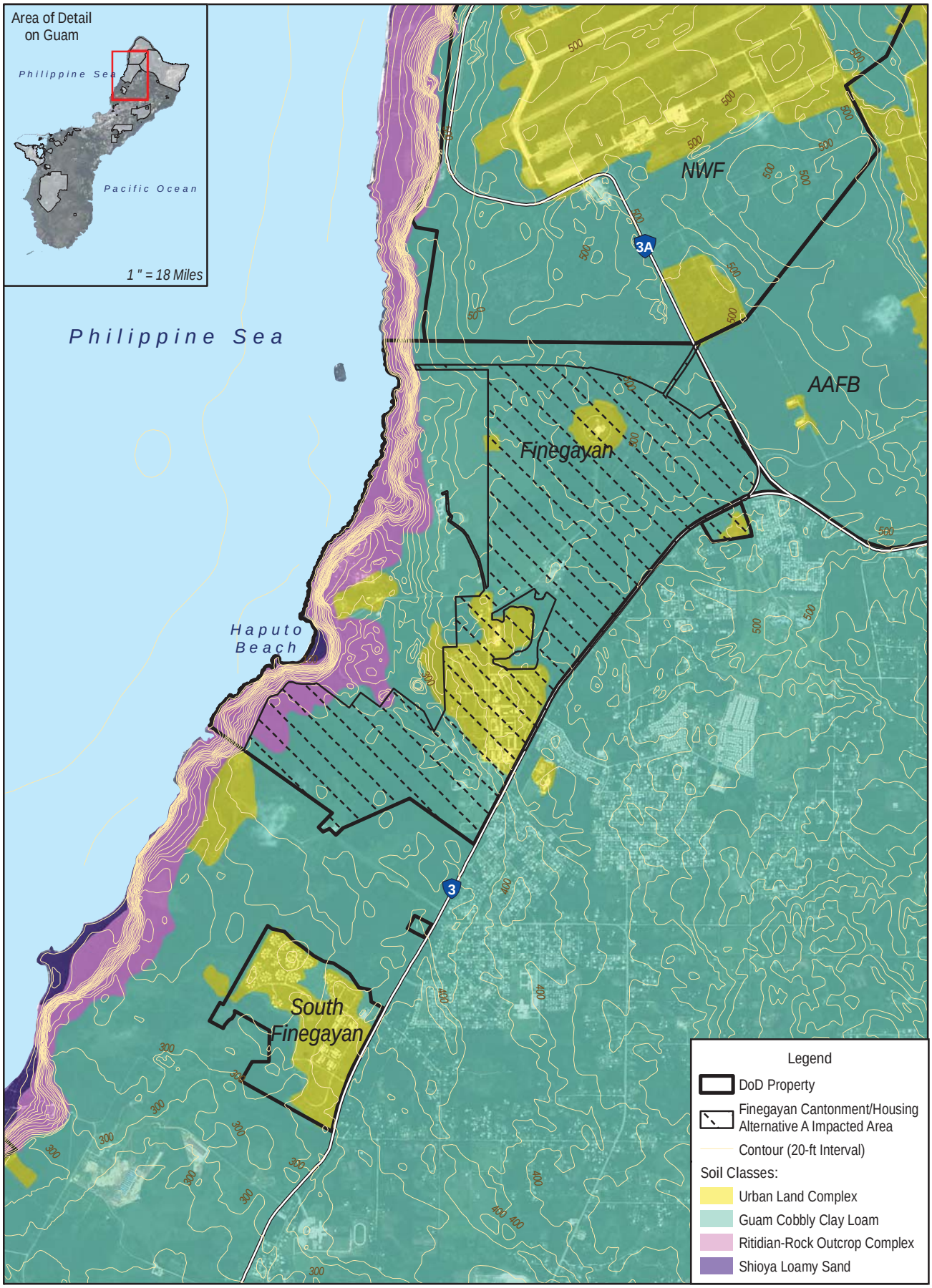


Figure 4.1.1-2
Soils in the Vicinity of
Finegayan Cantonment/Housing Alternative A

Urban Land comprises areas covered by roads, parking lots, buildings, and other impervious surfaces. The cliffline areas (Ritidian-Rock Outcrop Complex soils) are primarily rock outcrops with a thin veneer of well-drained coralline limestone soils. The near-level topography of the plateau and plant cover at Finegayan protect the thin soils from erosion.

With respect to geologic hazards (see Section 3.1.1.1) three minor faults are mapped within the Alternative A footprint (see Figure 4.1.1-1). However, the likelihood for landslides is generally low within the Alternative A footprint because there are no steep slopes (see Figure 4.1.1-2). The Alternative A footprint area has a low risk of liquefaction because soils overlying the limestone bedrock are shallow and well-drained, and the consolidated limestone bedrock does not lose cohesiveness in response to ground shaking during an earthquake. The lowest elevation (approximately 200 feet [61 m]) within the Alternative A footprint is at a higher elevation than the maximum observed wave vertical run-up recorded for tsunamis at Guam. Thus, the Alternative A site is not subject to tsunami inundation. The limestone bedrock in the area of Alternative A presents a potential hazard of surface instability and collapse due to sinkholes.

4.1.1.2 Environmental Consequences

Potential geology and soil impacts addressed in this section are limited to elements of the proposed action that could affect onshore landforms or that could be affected by geologic hazards. Potential soil contamination issues are addressed in Section 4.1.16.2 of this SEIS (Hazardous Materials and Waste).

Construction

Construction of the new cantonment/family housing area, associated support facilities, and roads associated with Alternative A would include clearing and grubbing, demolition of existing road pavement, excavation, filling, and landscaping. Earthwork for construction of the cantonment/family housing areas and associated infrastructure for Alternative A would include 3,159,000 yd^3 (2,415,230 m^3) of cut (excavation) and 2,483,000 yd^3 (1,898,391 m^3) of fill, resulting in a net of 676,000 yd^3 (516,839 m^3) of cut material available for use as needed. Of the action alternatives, Alternative A would have the second smallest excavation volume (Alternative C would be the smallest; Alternative E would be the largest).

Although this represents a large volume of earth movement, the near-level limestone plateau where the work would occur is not characterized by any substantial grade changes such as steep hills or canyons that would be leveled or filled. For this reason, only relatively minor changes in grade are anticipated to provide a buildable surface for construction of buildings, parking lots, and roadways associated with Alternative A. Because construction of Alternative A does not involve major elevation changes, substantially alter the surrounding landscape, affect important geologic features, or diminish slope stability, there would be a less than significant direct, long-term impact to topography and slope stability.

There is a potential for increased erosion, compaction, and soil loss from physical disturbance caused by construction activity and changes to existing topography. However, project design and construction would incorporate engineering controls as BMPs to minimize erosion, as required by 22 GAR, Chapter 10, Guam Soil Erosion and Sediment Control Regulations. Examples of such engineering controls include:

- Use of drainage diversion and control to direct stormwater flow away from construction sites.
- Use of benches or terraces and drainage control on cut or fill slopes higher than 15 feet (5 m) to minimize erosion on slope faces.
- Limiting the size of the unstabilized disturbed areas for each project to less than 20 acres (8 ha) during construction.

- Complying with the DoD Program-level SWPPP for construction, in addition to individual project SWPPPs during construction to reduce the potential for erosion, runoff, sedimentation, and stormwater pollutant loading.
- Planning earth-moving operations for periods of low rainfall to minimize exposure of disturbed soil to potential runoff.
- Re-vegetating and permanently stabilizing disturbed areas as soon as possible.

In addition, as described in Water Resources, Section 4.1.2.2 of this SEIS, construction activities associated with Alternative A would comply with the Construction General Permit. Potential construction-specific stormwater BMPs listed in Section 4.1.2-2 would be implemented to provide erosion and sediment control during the construction period, generally by employing on-site measures that reduce the flow of stormwater and minimize the transport of soils and sediment off-site. Fill material would be generated on-site, whenever possible. In addition, roadway-specific BMPs, as identified in the most recent *CNMI and Guam Stormwater Management Manual*, would be included in the planning, design, and construction of all roadways and facilities. Through compliance with 22 GAR Chapter 10 and the Construction General Permit, implementation of roadway stormwater BMPs, and not substantially increasing the rate of erosion and soil loss in the area, direct, short-term impacts to soils from erosion during construction of Alternative A would be less than significant. In addition, no indirect, short-term impacts associated with soil erosion are expected.

The soil that would be disturbed by construction of Alternative A is not identified as prime farmland by USDA (Young 1988). Therefore, disturbance of soil during construction of Alternative A would not result in reduced amounts of productive soils. There would be no direct or indirect impacts to agricultural soils.

There are 43 topographic features that may contain sinkholes in the Alternative A footprint (see Figure 4.1.1-1). For any sinkholes discovered before or during construction, BMPs would include compliance with the requirements of 22 GAR Chapter 10 § 10106F. In order to ensure compliance with 22 GAR Chapter 10 § 10106F, BMPs would be modified or an environmental and hydrogeologic assessment must be performed to ensure adverse effects will not result, including but not limited to the displacement of groundwater, interference with well production, significant changes to groundwater recharge, flooding, or the threat or introduction of any pollutant to groundwater. After a preferred alternative is selected and the ROD is signed for the proposed project, final design work would begin for the preferred alternative site. A geotechnical study, including subsurface borings, would be conducted to determine whether the depressions on the site contain sinkholes, and whether there are additional sinkholes not evident from the surface. Hydrogeological studies would be conducted to confirm groundwater flow at the site as well. The geotechnical and hydrogeological studies would be coordinated with the GEPA to design and implement an appropriate analysis. These studies would be part of the final design process and would take place before any construction begins. With implementation of these BMPs, and since no sinkholes would be filled that would adversely affect site drainage, no adverse impacts to sinkholes would occur. Therefore, construction of Alternative A would have less than significant direct, short-term impacts to sinkholes.

With respect to geologic hazards, proposed Alternative A facilities would be located on relatively level areas that would not be subject to slope instability. The consolidated limestone bedrock is not vulnerable to liquefaction in an earthquake. Structural hazards associated with earthquake ground motion and fault rupture would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 (USACE 2013). As stated in the previous paragraph, 22 GAR Chapter 10 § 10106F requires that for sinkholes within the project development footprint that would be modified or used, an environmental and

hydrogeologic assessment must be performed to ensure adverse effects will not result. Compliance with these regulations would minimize potential geologic hazards associated with sinkholes. Therefore, construction of Alternative A would result in less than significant direct and indirect short-term impacts associated with geologic hazards.

Construction of the proposed utility routing for Alternative A and off-site utility expansions common to all cantonment/family housing alternatives (see Figures 2.4-5 and 2.4-14, respectively, in Section 2.4.4.6 of this SEIS) would take place in bedrock, soil, slope, and seismic conditions similar to those described above for Finegayan. The proposed utility corridors would follow existing roadways, so the construction would occur primarily in previously disturbed areas. The same BMPs described for the cantonment/family housing construction would be implemented for the utility construction. Therefore, under Alternative A, direct and indirect short-term impacts of construction of the utility routing to sinkholes, to soils from erosion, and with respect to seismic hazards would be less than significant. Construction of the utility routing would involve minimal excavation and filling, so direct long-term impacts to topography and slope stability would be less than significant. No prime farmland is identified in the utility route footprint, so there would be no direct or indirect impacts to agricultural soils.

Under any of the proposed cantonment/family housing alternatives, approximately 11 new potable water wells would be drilled in undeveloped areas of AAFB. As described in Section 4.1.2.2, the proposed wells would be sited and constructed in compliance with GEPA regulations. Any exploratory/test wells not converted to production wells would be properly sealed and backfilled to prevent the boreholes from acting as potential routes of contamination to the aquifer, in compliance with GEPA regulations. A mandated 1,000-foot (305-m) buffer identified as a wellhead protection zone would be established around the 11 new wells. Within this zone, prior to undertaking future activities and/or development, the DON would consult with and seek approval from GEPA to ensure appropriate measures and BMPs are implemented to protect the integrity of the island's freshwater aquifers.

A system of pipes would be installed to connect the wells to an aboveground holding tank that would connect to the DoD water transmission system (see Section 2.2.4 and Figure 2.4.14 in Section 2.4.4.6 of this SEIS). The drilling and construction activities would take place in a similar geologic and seismic setting as described for Finegayan. Well drilling and pump installation at the well sites and pipeline and water tank construction would involve minimal surface and subsurface disturbance, so direct long-term impacts to topography and slope stability would be less than significant. The same BMPs as those described for the cantonment/family housing construction would be implemented. Therefore, under Alternative A, the direct and indirect short-term impacts of construction of the water wells and holding tank to soils from erosion and with respect to seismic hazards would be less than significant. Given compliance with 22 GAR Chapter 10 § 10106F there would be no adverse impacts to sinkholes and direct short-term impacts to sinkholes would be less than significant. No prime farmland is identified in the well field development footprint, so there would be no direct or indirect impact to agricultural soils.

Construction of the proposed utility and school expansions common to all alternatives (see Figure 2.4-14 in Section 2.4.4.6 of this SEIS) would also occur in geologic and seismic settings similar to those described above for Finegayan. Construction of the school expansions would occur in previously developed areas, and the same BMPs would be implemented as described for the cantonment/family housing construction. With implementation of BMPs potential geologic hazards of sinkholes would be minimized and there would be no adverse impacts to sinkholes. Therefore, construction of the proposed utility and school expansions common to all alternatives would have a less than significant direct, short-term impact to sinkholes. Under Alternative A, the direct and indirect short-term impacts of construction

of the utility and school expansions to soils from erosion and with respect to geologic hazards would be less than significant. Construction of the utility and school expansions would involve minimal excavation and filling, so direct long-term impacts to topography and slope stability would be less than significant. No prime farmland is identified in the utility and school expansion footprint, so there would be no direct or indirect impacts to agricultural soils.

Operation

Residential, recreational, commercial, and administrative uses of the Alternative A facilities during the operation phase (i.e., after construction of Alternative A and projects common to all alternatives has been completed) would take place on previously disturbed land (i.e., land disturbed during the construction phase). Ground disturbance associated with Alternative A operations would be minimal, mostly resulting from minor excavations for maintenance and repair of underground utilities (including the proposed off-site utility expansions and the new well pipes) or other related activities. There would be no large-scale grading, excavation or filling during the operation phase, so there would be no direct or indirect impact to topography and slope stability. The project engineering drainage controls, slope and soil stabilization/re-vegetation measures initiated during construction to minimize erosion within the project construction footprint would remain in place in the operational phase. Implementation of these measures would minimize the conditions that cause soil erosion (e.g., un-vegetated soil exposed to rainfall, uncontrolled runoff) so the direct and indirect long-term impacts to soils from erosion would be less than significant.

No prime farmland is identified within the Alternative A project footprint. Therefore, there would be no direct or indirect impacts to agricultural soils as a result of Alternative A operations.

The BMPs for sinkholes would be implemented in the event that maintenance activities should involve sinkholes or their immediate perimeter to avoid adverse impacts to sinkholes from occurring. Therefore, Alternative A operations would have less than significant direct, long-term impacts to sinkholes.

The potential geologic hazards associated with slope instability and liquefaction are minimal at Finegayan. Potential structural damage or injuries during operations from seismic ground-shaking and fault rupture would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 (USACE 2013), so direct and indirect long-term impacts with respect to seismic hazards would be less than significant. Implementation of sinkhole BMPs would minimize potential geologic hazards associated with sinkholes. Therefore, Alternative A operations would have less than significant direct, long-term impacts associated with geologic hazards.

Under Alternative A, operation of the proposed utility and school expansions that are common to all alternatives would take place on land previously disturbed during the construction phase. Similar to the operational phase of Alternative A, ground disturbance associated with the operational phase of the utility and school expansions would be minimal, mostly resulting from minor excavations for maintenance and repair of underground utility systems, and water supply system expansions. The same BMPs described for the Alternative A operations would be implemented for operational phase actions involving the utility and school expansions. Therefore, under Alternative A, the operation of the utility and school expansions would have no impacts to topography and agricultural soils, and direct and indirect long-term impacts to soils from erosion would be less than significant. With implementation of BMPs no adverse effects on sinkholes would occur. Therefore, operation of the proposed utility and school expansions common to all alternatives would have a less than significant direct, long-term impact on sinkholes. Potential for geologic hazards such as slope instability, liquefaction, and tsunamis at Finegayan is minimal, and implementation of sinkhole BMPs would minimize potential geologic hazards associated with sinkholes.

Therefore, operation of the utility and school expansions common to all alternatives would have less than significant direct and indirect long-term impacts associated with geologic hazards.

4.1.2 Water Resources

4.1.2.1 Affected Environment

The affected environment for water resources associated with Alternative A is described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.1.2.2: Finegayan, page 4-26).

Surface Water

As indicated in the 2010 Final EIS, there are no surface water resources in the Finegayan project area or the utility corridor to AAFB. There are also no surface waters in the project areas for the proposed school expansions and off-site utilities that would be common to all cantonment/family housing alternatives. The general flow path of surface stormwater runoff at the Finegayan site is from northeast to west-southwest. Runoff through the Finegayan site includes stormwater from off-site areas to the north and east. Runoff primarily occurs during intense storm events via overland sheet flow, channelized flow, and through a series of depressions and sinkholes. Based on analysis of topography, most runoff is likely captured by these depressions and sinkholes and infiltered into the ground prior to reaching the Philippine Sea or Haputo Bay (Figure 4.1.2-1). Existing impervious areas on the Finegayan project area amount to approximately 60 acres (24 ha), or about 4.1% of the proposed Finegayan impacted area of 1,452 acres (588 ha).

The Federal Emergency Management Agency (FEMA) has identified areas on Guam that are likely to be inundated during a 100-year or 500-year flood event (FEMA 2007). There are no 100-year or 500-year flood zones identified within the proposed Finegayan impacted area (Figure 4.1.2-1).

Groundwater

As indicated in the 2010 Final EIS, the Finegayan project area and the utility corridor to AAFB overlie the Finegayan and Agafa-Gumas basins of the NGLA. The project areas for the proposed school expansions and off-site utilities that would be common to all cantonment/family housing alternatives overlie the Finegayan, Agafa-Gumas, Andersen, and Yigo basins of the NGLA.

The DON and GWA signed an MOU in July 2010 establishing objectives and an interagency framework for further discussions regarding solutions to address increased wastewater and potable water requirements under the proposed buildup. This interagency framework consists of three-tiers: executive level, middle-management level, and scientific/technical level. The specified purposes of the framework include the following:

- Sharing of data.
- Reliable and timely interpretation of data.
- Provision of scientifically informed recommendations to support.
- Timely decisions and constructive multi-agency agreements between agency heads.

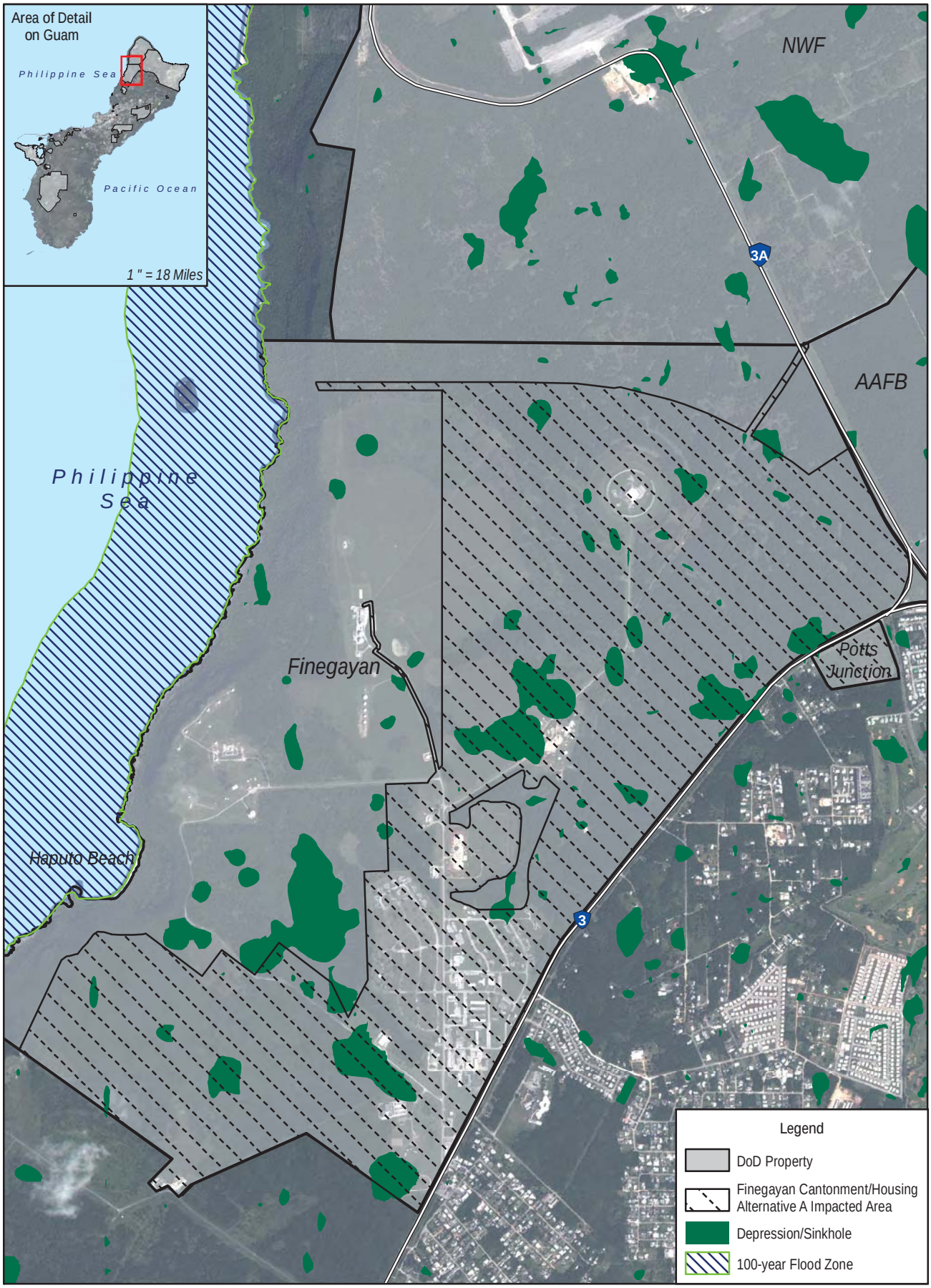


Figure 4.1.2-1
Water Resources in the Vicinity of Finegayan Cantonment/Housing Alternative A

Sources: FEMA 2007; NAVFAC Pacific 2013; WERI 2001

The commitments stated in the MOU between the DON and GWA include protecting the NGLA and the joint management of the aquifer. Proposed solutions in the MOU include the following:

- Cooperation among the parties in completing studies related to meeting the water needs of Guam including NGLA sustainability studies, which will be coordinated with GEPA, USGS and WERI, as needed.
- Cooperation among the parties in selection of future water well sites.
- Cooperation among the parties in developing appropriate plans for the integration of new water production and distribution infrastructure with existing water systems.
- Share water resources as needed to address urgent needs.

The framework provides a venue for joint management of all of Guam's water resources, including groundwater. A Senior Advisory Group was formed under the MOU and consists of DoD, GEPA, GWA, Consolidated Commission on Utilities, and WERI. In 2012, the Senior Advisory Group evolved from protecting just the NGLA to protecting all water resources on Guam and is now called the Guam Water Resources Development Group (GWRDG). The mission of the GWRDG is to protect Guam's water supply for quantity, quality, reliability, sustainability, and availability for all of Guam - present and future. The GWRDG will meet with technical experts to manage NGLA groundwater monitoring efforts, while addressing interagency interests and concerns, and then make recommendations. The GWRDG will resolve interagency issues and establish formal agreements and commitments for implementing the NGLA monitoring objectives and timelines. A draft set of bylaws, based on the MOU, was informally distributed in November 2014 and is currently under review by members of the affected local and federal agencies.

Guam's freshwater aquifers are susceptible to contamination from surface activities (e.g., sewage spills, leachate from septic systems, and recharge of polluted stormwater runoff) and from saltwater intrusion from over pumping. The high permeability of the limestone in northern Guam allows rapid infiltration of rainfall, and the large pore size in the limestone formations allows contaminants (if present in the surface water) to reach the groundwater aquifer. As a result, the classification of the NGLA as GWUDI of surface water was investigated with assistance from the USEPA, through a GEPA working group (now the GWRDG) focused on the GWUDI issue on Guam (NAVFAC Pacific 2011). In a December 2013 Formal Letter to the GWA, GEPA declared that Guam's groundwater is not GWUDI of surface water (GEPA 2013a), and therefore is not subject to applicable local and federal Surface Water Treatment Rules (GEPA 2013b). However, GEPA strives for the highest standards of water quality and may still require treatment (e.g., mandatory chlorination for all wells) even if this step would be more stringent than federal requirements.

Recently available closed circuit television films of the GWA interceptor sewer from AAFB to the Northern District WWTP show these reinforced concrete pipes to be in an advanced state of deterioration. These sewer lines are in need of refurbishment as their failure could cause impacts to groundwater.

The WERI and USGS have a formal collaboration in place under the Guam Comprehensive Water Monitoring Program (CWMP) established by Guam Public Law 24-161. Under PL 24-161, the Guam Legislature allocates annual funding to WERI to provide Guam's contribution to the local-federal cost-sharing agreement that supports the CWMP. The WERI and USGS work together to leverage local expertise and nationwide scientific resources to study water resource issues of interest on Guam. Under the existing CWMP, USGS and WERI currently collect data on water-table elevations and lens thickness from monitoring wells in the three groundwater basins that are most heavily utilized for civilian municipal water supply. Additional monitoring wells are needed in the other three basins, which include

the two basins in which new groundwater development is anticipated to support the proposed action on Guam. An expanded monitoring program coupled with periodic trend analysis and groundwater modeling is needed to evaluate salinity changes in the NGLA.

With expected population increases on Guam resulting from implementation of the proposed action, there has been concern over subsequent increase in groundwater withdrawals from the NGLA. Withdrawal rates from the NGLA are currently about 40 MGd (150 MLd) (Table 4.1.2-1) (USGS 2013a) and is approximately half of the 1991 sustainable yield estimates of 80 MGd (300 MLd). As shown in Table 4.1.2-1, there is currently available yield for all the basins except for the Yigo-Tumon Basin, which exceeds the 1991 sustainable yield estimates by 0.1 MGd (0.4 MLd).

Table 4.1.2-1. Sustainable Yield Estimates and 2010 Annual Average Pumping, NGLA

Basin	*1982 Sustainable Yield (MGd)*	*1991 Sustainable Yield (MGd)*[1]	*Current Well Production (MGd)*	*Current Available Yield (MGd)*[2]
Agaña	11.7	20.5	9.0	11.5
Mangilao	3.9	6.6	2.2	4.4
Andersen	6.2	9.8	0.8	9.0
Agafa-Gumas	10.1	12.0	2.1	9.9
Finegayan	6.4	11.6	6.1	5.5
Yigo-Tumon	19.1	20.0	20.1	-0.1
Total	**57.4**	**80.5**	**40.3**	**40.2**

Notes: [1]As part of the 2010 Final EIS, a re-evaluation of the sustainable yield of the NGLA was conducted and confirmed that the 1991 sustainable yield estimate is more appropriate.
[2]The current available yield is the difference between current well production and the 1991 sustainable yield.
Sources: GEPA 1982; GovGuam 1992; NAVFAC Pacific 2008; USGS 2013a.

Due to concerns over increased groundwater withdrawal, the DoD funded the USGS to conduct a groundwater availability study that would provide information and tools to more effectively manage Guam's groundwater resources. The goals of this study were to (1) advance the understanding of regional groundwater dynamics in the NGLA; (2) provide a new estimate of groundwater recharge for the entire island; and (3) develop a numerical groundwater flow and transport model for northern Guam that would serve as a tool to assist water resource managers in estimating the effects of selected groundwater-pumping and climate scenarios on the water supply (USGS 2013b). The USGS worked with the WERI to develop a daily water budget model to estimate mean recharge for various land cover and rainfall conditions (USGS 2012). Development of the model began in 2009 and was completed in 2013. The 2012 water budget model estimated total recharge for the northern aquifer basins to be 42% greater than total recharge estimated by the 1982 Northern Guam Lens Aquifer Study (USGS 2012). The calibrated groundwater model was used to simulate changes in water levels and salinity under several hypothetical withdrawal and recharge scenarios and the results were published in *The Effects of Withdrawals and Drought on Groundwater Availability in the Northern Guam Lens Aquifer, Guam* (USGS 2013c). The groundwater study looked at two different climate scenarios: recharge estimates based on both historical average climate conditions and drought rainfall conditions (USGS 2013c).

The study looked at simulated salinities at selected GWA and DoD wells to evaluate the effects of various pumping scenarios. Based on the secondary drinking water standard for chloride of 250 milligrams per liter (GEPA 2001), simulated salinities are classified as acceptable if they are below about 200 milligrams per liter chloride concentration, cautionary if they are between 200 and 500 milligrams per liter chloride concentration, and threatened if they are greater than 500 milligrams per liter chloride concentration (USGS 2013c). Water in the cautionary category is near or above the standard but could be blended with fresher water to meet the standard and water in the threatened category is well above the standard (USGS

2013c). The analysis in this SEIS compares existing groundwater withdrawal scenarios (i.e., 2010 withdrawal rates for both historical average climate conditions and drought rainfall conditions) to various withdrawal scenarios under Alternative A (see Section 4.1.2.2). In general, the freshwater lens gets smaller and salinities increase when withdrawal increases or recharge is reduced during drought (USGS 2013c).

Nearshore Waters

As indicated in the 2010 Final EIS, nearshore waters at Finegayan include Haputo Beach and are classified as having M-1 water quality, the use of which is primarily recreational.

The Finegayan project area would be served by the Northern District WWTP, which discharges into the Philippine Sea near Tanguisson Beach. As discussed in the 2010 Final EIS (Volume 6, Chapter 6: Water Resources, Section 6.2.4.1: Basic Alternative 1a (Preferred Alternative), pages 6-17 to 6-18), Tanguisson Beach is included in GEPA's impaired water bodies 303(d) list for bacteria, and USEPA Region 9 approved a TMDL for Tanguisson Beach in March 2010. The TMDL for Tanguisson Beach includes a load allocation for bacteria (*Enterococci*) for the Northern District WWTP that would be imposed under an NPDES permit (USEPA and GEPA 2009). In April 2013, the USEPA issued an NPDES permit for the Northern District WWTP establishing discharge limits consistent with secondary treatment levels and Guam Water Quality Standards, including those for nutrients. An upgrade to the Northern District WWTP treatment systems is required by the USEPA to support compliance with the 2013 NPDES Permit, the achievement of the TMDL for bacteria at Tanguisson Beach (*Enterococci*), and attainment of water quality goals (USEPA and GEPA 2009).

The GWA completed interim primary treatment upgrades to the Northern District WWTP in December 2012 as required by a 2011 court order. The Northern District WWTP must undergo additional upgrades to comply with a new NPDES permit issued by the USEPA at the facility for 12.0 MGd (45.4 MLd) (USEPA 2013a). The current average daily flow to the Northern District WWTP is 5.1 MGd (19.3 MLd) and discharge limits and compliance requirements are dictated by the 2013 NPDES permit; however, the Northern District WWTP is currently not able to meet the new treatment discharge limits of the 2013 NPDES permit. See Section 4.1.14, Utilities, in this SEIS for additional details on the permit requirements for the Northern District WWTP.

Wetlands

As indicated in the 2010 Final EIS, no wetlands were identified at the Finegayan project area or the utility corridor to AAFB. There are also no wetlands in the project areas for the proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities that would be common to all cantonment/family housing alternatives.

4.1.2.2 Environmental Consequences

Construction

General construction impacts to water resources at Alternative A would be similar to those described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-84 to 4-88). Under Alternative A, there would be construction activities associated with the proposed cantonment/family housing at Finegayan, the utility corridor to AAFB, and projects that are common to all cantonment/family housing alternatives (the proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities).

Construction of the proposed new cantonment/family housing and associated support facilities along with other construction activities associated with the proposed action would occur in an area that does not contain waters of the U.S. Nevertheless, the USGS indicates that discharge to nearshore waters is possible through the porous limestone geology of northern Guam (USGS 2012). Although there is a potential for construction-related discharge to the ocean, it is highly unlikely that it will occur and would be limited to extreme events with very heavy rainfall, such as tropical storms and typhoons. The limestone geology would filter substantial amounts of soil particles. However, to minimize potential short-term impacts to groundwater and nearshore water resources associated with stormwater runoff, construction activities under Alternative A would comply with the Construction General Permit.

Construction under Alternative A would disturb a large area (i.e., >5 acres [2 ha]), and therefore would qualify as a large construction activity per Phase I Stormwater Regulations (see 2010 Final EIS, Volume 2, Chapter 4: Water Resources, Table 4.1-1 for NPDES permitting requirements). Under this requirement, an NOI would be submitted to USEPA to seek coverage under the Construction General Permit. By submitting an NOI, the owner or operator of the project acknowledges that it is eligible for coverage under the Construction General Permit and agrees to the conditions in the Construction General Permit. The comprehensive Program SWPPP prepared for the 2010 Final EIS (NAVFAC Pacific 2010a) was updated for the proposed action in 2014 (NAVFAC Pacific 2014). The 2014 Program SWPPP provides an integrated, comprehensive approach to stormwater management for all construction projects associated with the proposed action. In addition to procedures and practices to prevent discharge of pollutants from construction sites and water resources in Guam, the 2014 Program SWPPP provides roles and responsibilities of various DON organizations as well as contractors/subcontractors, regular monitoring and BMP inspection, evaluation, training, and reporting procedures. Submittal of BMP inspection reports and discussion of stormwater non-compliance at weekly QC/construction progress meetings would be required. The 2014 Program SWPPP also addresses compliance inspections during wet weather (weekly during dry periods and daily, along with pre- and post-storm during storm/rain events), details of inspection procedures, and documentation requirements. Details of the non-compliance or discharge reporting to the DON organizations and USEPA Region 9 are also included, as well as stormwater compliance enforcement procedures, which include discovery of non-conformance, reporting potential non-compliance, and contractual enforcement.

In compliance with the Construction General Permit and the 2014 Program SWPPP, site-specific SWPPPs would be prepared and be readily available on-site as a condition of the Construction General Permit. As listed in Table 2.6-1 in Section 2.6 of this SEIS, the SWPPP is a BMP that would identify construction-specific BMPs to be implemented as part of Alternative A to reduce the potential for erosion, runoff, sedimentation, and stormwater pollutant loading potential. In addition, roadway-specific BMPs, as identified in the most recent *CNMI and Guam Stormwater Management Manual*, would be included in the planning, design, and construction of all roadways and facilities. Potential construction-specific BMPs may include but are not limited to those listed in Table 4.1.2-2. The project would also prepare an Erosion Control Plan and obtain and comply with all Clearing, Grading, and Stockpiling Permits issued by GEPA.

Table 4.1.2-2. Potential Construction-Specific BMPs and Function

Potential BMP	*Function*		
	Erosion Control	*Runoff Reduction*	*Sediment Removal*
Check Dam	●		
Diversion Dike/Swale	●	●	●
Level Spreader	●	●	
Perimeter Dike/Swale		●	●
Sediment Basin			●
Sediment Trap			●
Silt Fence			●
Fiber Rolls	●	●	●
Gravel/Sand Bag Berms		●	●
Stabilized Construction Entrance/Exit			●
Storm Drainage Inlet Protection			●
Straw Bale Dike			●
Vegetated and Lined Waterways	●	●	
Rock Outlet Protection	●		
Erosion Control Blankets	●		
Stabilization with Vegetation, Sod, Mulch, or Topsoil	●		●

Note: For a detailed description of potential BMPs, see Table 4.2-1 in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.1.1: Methodology, pages 4-76 to 4-79).

Construction under Alternative A would result in the potential for short-term increases in stormwater runoff and erosion. However, through compliance with the Construction General Permit and Program SWPPP and implementation of a site-specific SWPPP and associated erosion control, runoff reduction, and sediment removal BMPs (see Table 4.1.2-2), these effects would be minimized and off-site transport of stormwater runoff would be unlikely unless during extreme weather events (i.e., typhoons). Specifically, the site-specific SWPPP would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flowrate of runoff and thereby minimize transport of suspended sediment through settling and promote infiltration of runoff.

Surface Water

No buildings/structures would be constructed in the 100-year or 500-year flood zones and no surface waters are located within or near the proposed construction areas under Alternative A. Given compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely. Therefore, construction activities associated with Alternative A would result in no impacts to surface waters.

Groundwater

Construction activities under Alternative A would include stormwater runoff protection measures that would also serve to protect groundwater quality. By adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific water resource protection requirements, there would be a reduction in stormwater pollutant loading potential and thus a reduction in pollution loading potential to the underlying groundwater basins of the NGLA. Consistent with 22 GAR Chapter 10 § 10106F, an environmental and hydrogeologic assessment for the selected alternative would be performed for sinkholes within the project development footprint to ensure adverse effects would not result, including but not limited to the displacement of groundwater,

interference with well production, significant changes to groundwater recharge, flooding, or the threat or introduction of any pollutant to groundwater.

Approximately 11 new wells at AAFB would be sited away from potential sources of contamination existing on or near AAFB, including Installation Restoration Program (IRP) sites, past hazardous activity locations, a utility corridor including a sewer line, stormwater injection wells, fuel storage, fuel transmission lines, and fuel pumping locations. The proposed wells would be sited and constructed in accordance with GEPA regulations. As part of the well permitting process, GEPA would conduct a review of each well location and review site-specific data. Pilot wells would be tested for water quality before converting them into production wells. If elevated contaminant levels (i.e., chlorides) are detected, the wells would be relocated.

There are seven active DoD water production wells currently producing water on Finegayan and several active GWA water production wells in the area along Route 3. Continued use of some of these wells would need to be negotiated with the GEPA due to the proximity of proposed cantonment facilities that are within the wellhead protection zone and could cause groundwater contamination. Through the use of best management practices and protective design features, it appears that it may be feasible to keep the DON Finegayan wells in service. Initial discussions regarding this approach were held with GEPA on May 16, 2014, and agreement in principle on this approach has been obtained. All construction and operation activities within the wellhead protection zone would be done in accordance with GEPA regulations, as described above.

As discussed in Section 4.1.14, Utilities, it would be expected that the GWA could meet the increased potable water demand during construction and that there would only be a minimal increase in pumping from the NGLA due to construction. However, the number of spills from GWA's sewage collection system continues to greatly exceed spill rate norms for similar wastewater systems. Increased wastewater flows associated with induced civilian growth and the additional construction/DoD workforce would potentially increase the rate of sewage spills, resulting in significant indirect impacts to groundwater quality.

To address impacts to public infrastructure, the FY 2014 NDAA (Public Law No. 113-66) directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system and expansion/rehabilitation of the NGLA monitoring well network for sustainment of the NGLA. To support this implementation plan, DoD assessed Guam's public infrastructure, including GWA's water and wastewater systems that may be affected by the preferred alternative. The water and wastewater assessment recommended the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs), the environmental and hydrogeologic assessment for sinkhole protection (if encroachment is unavoidable), siting and construction of wells in accordance with GEPA regulations, minimal increase in water demand or withdrawal from the NGLA, and DoD assistance

in identifying funding to upgrade sewer lines, construction activities associated with Alternative A would result in less than significant short-term direct impacts to groundwater.

Nearshore Waters

Many of the construction activities under Alternative A would be near the coastline. Specifically, the family housing component of the Finegayan project area would be located on the cliff at an elevation of approximately 360 feet (110 m) and 0.1 mile (0.2 km) from Haputo Beach. The proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities that would be common to all cantonment/family housing alternatives are not located within 1 mile (1.6 km) of nearshore waters except for the DoDEA High School, which would be 0.15 mile (0.25 km) from nearshore waters.

Given compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP, indirect impacts from off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely (see discussion of BMPs under *Construction*). In addition, the Haputo ERA Management Plan requires a no construction buffer of 100 feet (30 m) from the ERA boundary. Beyond the no-construction buffer zone, there would be a 200-foot (60-m) buffer zone where landscaping, fencing, and mowing would be allowed. There would also be an additional buffer of approximately 440 feet (134 m) from the cliffline to the Haputo Bay shoreline (total of 0.1 mile [0.2 km]). The vegetative cover over this distance would provide additional buffer and protection from stormwater runoff or sediment reaching Haputo Bay. Given adherence to the provisions of the Construction General Permit and implementation of BMPs, it is expected that stormwater runoff, sediment, or other pollutants would not discharge to nearshore waters.

Induced civilian and construction/DoD workforce growth during construction of the cantonment/family housing facilities under Alternative A would increase demand for wastewater treatment at the Northern District WWTP and disposal of generated wastewater. Due to the reduced population projection and related smaller increase in demand under the 2012 Roadmap Adjustments, this increase in wastewater discharge from the Northern District WWTP would be less than under the No-Action Alternative. However, as discussed in Section 4.1.14, Utilities in this SEIS, upgrades to the Northern District WWTP are already needed for the plant to achieve compliance with the current NPDES permit. Increasing the wastewater discharge from a non-compliant treatment plant could result in significant indirect impacts to nearshore waters during the period of non-compliance. The significance of nearshore waters impacts resulting from implementation of Alternative A would be similar to that associated with implementing Alternatives B, C, D and E.

Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate significant impacts to nearshore waters once the upgrades are completed. Until the WWTP upgrades are completed (anticipated to be early in the operational phase of the proposed action) there would be an indirect and unmitigable significant impact to nearshore waters during construction.

Wetlands

No wetlands are located in or near the construction areas associated with Alternative A. Therefore, construction activities associated with Alternative A would result in no impacts to wetlands.

Operation

Alternative A would incorporate a LID approach in the final planning, design, and construction of the stormwater management system as described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-85 to 4-87) and 2012 Roadmap Adjustments update.

Implementation of LID would be in accordance with UFC 3-210-10 *Low Impact Development*, EO 13514, and *Technical Guidance on Implementing Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act* (USEPA 2009). Specifically, the project-related goals for water quality and groundwater recharge listed below would be followed:

- Obtain Leadership in Energy and Environmental Design Silver Certification for all new buildings (per *Engineering and Construction Bulletin 2011-01* [NAVFAC Pacific 2010a]):
  - Achieve the Sustainable Sites Credit 6.2 (Stormwater Quality Management) 1-point.
  - Capture and treat runoff from 90% average annual rainfall using BMPs.
  - Remove 80% of average annual post-development total suspended solids (TSS).
- Follow EO 13514 and USEPA Technical Guidance (USEPA 2009) to capture and retain all stormwater up to and including the 95% storm event (2.2 inches [5.6 cm]).
- Use a LID approach to meet 95th percentile goal (per *DoD Implementation of Storm Water Requirements under Section 438 of the Energy Independence and Security Act [EISA]* [DoD 2010] and UFC 3-210-10).
- Provide required water quality (per *CNMI and Guam Stormwater Management Manual* [Horsley Witten Group, Inc. 2006]):
  - Based on 0.8 inch (2 cm) over the impervious areas, for moderate quality resource areas.
  - 100% of this volume requires capture and treatment.
- Provide required groundwater recharge (per *CNMI and Guam Stormwater Management Manual* [Horsley Witten Group, Inc. 2006]):
  - Limestone Areas: groundwater recharge based on 1.5 inch (3.8 cm) of precipitation from all impervious surfaces.
  - Volcanic Areas: Match natural rate based on hydrologic soil group method calculations.

LID would actively manage stormwater runoff from a 95% annual average rainfall event by mimicking a project site's pre-development hydrology using design techniques that would infiltrate, store, and evaporate runoff close to its source or origin. Example water quality/resource protection practices that would be considered beyond the LID approach include pollutant loading reduction from building design and segregation of pollutants from stormwater, integrated pest management, native plant landscaping, avoidance of pesticides and fertilizers, implementation of household hazardous waste collection programs, and the use of transit/shuttle programs to minimize single occupancy vehicles and their related pollutants. These and other water quality protection measures would control or attenuate stormwater runoff, providing treatment before recharging underlying groundwater aquifers or, should the flow levels require, stormwater would enter detention basins as described below.

In areas of karst geology such as much of northern Guam, LID techniques must also protect groundwater quality by removing pollutants prior to infiltrating runoff into the underlying aquifer. LID designs would focus on small scale, close to the source stormwater management, where such techniques help achieve the water quality goals for each project site (see Appendix F for examples of LID applications that would be used). The combination of applied LID technologies and compliance with federal and GovGuam water quality regulations are intended to eliminate the potential for impacts on nearby receiving water bodies and would minimize the potential for adverse impacts on underlying groundwater aquifers from the development of Alternative A. As indicated in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Table 4.2-2), BMPs utilized by LID are well suited to reduce stormwater runoff and associated pollutant loading for a variety of potential contaminants including sediment, nutrients, suspended solids,

and heavy metals. The application of LID practices at the planning level is in conformance with USEPA non-structural pollution prevention strategies.

The proposed stormwater management system infrastructure improvements included as part of the proposed action would incorporate LID measures and BMPs for compliance with local and federal requirements that are designed to minimize potential impacts to downstream development, sensitive water resources, and ecology. Planning recommendations for capturing, treating, and retaining the 95% exceedance stormwater flows have been prepared for the Guam and CNMI Military Relocation 2012 Roadmap Adjustments (see Appendix F for LID applications) and would be adopted in design and operation. As part of the initial planning, the project area was delineated into sub-basins with stormwater conveyance systems to route discharges to appropriately sized detention basins within each sub-basin when flow requires these discharges. For storms greater than the 95% exceedance storm, it is expected that the water quality features would overtop, requiring these detention basins, and stormwater would be directed via the stormwater conveyance systems to detention basins that would control discharge rates while providing additional water quality treatment and groundwater recharge.

Alternative A would also be implemented in accordance with all applicable orders, laws, and regulations (see the 2010 Final EIS Volume 8, Table 3.1-1). SWPPPs and SWMPs are documents designed to identify ways to reduce the potential impacts associated with pollution sources and erosion and sedimentation impacts, respectively. In addition, the Oil Pollution Act mandates the implementation of the Spill Prevention, Control, and Countermeasure (SPCC) Plan that is used to prevent and control potential leaks.

Under Alternative A, the total impervious area on the Finegayan project area would increase by 273 acres (110 ha). This increase from 4.1% to 23% impervious area, for a total of 333 acres (135 ha), would result in an associated increase in stormwater runoff volume for each of the design storm events. The utility corridor to AAFB and the proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities that would be common to all cantonment/family housing alternatives would result in minimal increase in impervious area.

Alternative A would result in increased runoff of 292 acre-feet (335,510 m^3) and 419 acre-feet (516,830 m^3) from the 25-year and 100-year design storms, respectively. However, the project design would include vegetated swales for conveyance and treatment and detention/retention ponds capable of capturing, storing, and treating additional runoff from the 25-year design storm (see Appendix F for examples of LID applications that would be used and conceptual design of stormwater runoff routing and pond locations). For each sub-basin, water quality treatment strategies were selected based on the effectiveness of BMPs to treat identified pollutants of concern from proposed land uses within each sub-basin. The selected water quality treatment strategies would achieve reductions of non-point source pollutants to meet the water quality requirements identified above.

Water quality is closely linked to the surrounding environment and land use. Stormwater runoff is affected by community uses such as agriculture, urban, and industrial use. Impervious surfaces accumulate a variety of pollutants that can be transported down-gradient to sensitive receptors. The potential pollutants of concern for the project site identified below are anticipated relative to military-related activities but have not been substantiated with site-specific stormwater monitoring data:

- Solids (suspended sediment, sediment, and floatable debris).
- Organics (oil and grease, total organic carbons, hydrocarbons, and methyl tertiary butyl ether).
- Metals (cadmium, chromium, copper, lead, nickel, and zinc).
- Nutrients (nitrogen and phosphorous).

- Pathogens (bacteria).

As indicated in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Table 4.2-2) and 2012 Roadmap Adjustments update, BMPs utilized as part of a LID approach are well suited to reduce the pollutant concentration within stormwater runoff for a variety of potential contaminants. The selected water quality treatment strategies identified estimated TSS reductions of 83.7% to 90.3%, total phosphorous reductions of 9.4% to 49.9%, and total nitrogen reductions of 11.2% to 62.6% for representative sub-basins. Similar water quality treatment strategies would be utilized under Alternative A and, therefore, similar levels of pollutant removal are expected. During final design phases of Alternative A, sediment, nutrient and heavy metal load reduction by water quality treatment strategies would be more accurately determined based on the LID device pollutant removal efficiency. Ultimately, a field monitoring program for pollutant removal efficiency would be implemented under the operations SWPPP and SWMP to measure the success of meeting pollutant removal requirements, and modify water quality treatment strategies and BMPs, as necessary. LID effectiveness in areas of karst geology is of special concern. While there is no current Guam requirement to monitor LID effectiveness post-construction, DON would develop and implement a "LID BMP Operations and Maintenance Inspection Checklist" consistent with the 2006 CNMI Guam Stormwater Management Manual to monitor and ensure the effectiveness of LID features during operation. Any deficiencies would be reported to and addressed by the future Public Works Department of the Marine Corps Base Guam.

The final LID/Drainage/Grading Study, dated July 2013, will be provided to the design team for guidance and implementation during design and construction. The designs performed by these contractors would be subject to review by DoD professionals and technical consultants to ensure proper implementation both during design and verification during construction.

Surface Water

No surface waters are located within the Alternative A project area and the implementation of a comprehensive stormwater management plan utilizing a LID approach would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event. Therefore, Alternative A would result in no impacts to surface waters.

Groundwater

Groundwater Recharge. Changes in land cover and increases in impervious area under Alternative A would include the removal of approximately 1,000 acres (400 ha) of secondary limestone forest and an increase 273 acres (110 ha) of impervious area for the Finegayan project area. This would alter the water budget in the project vicinity, resulting in direct, long-term impacts to groundwater supplies. In areas of limestone forest, canopy storage captures a portion of the rainfall and it is estimated that 85% of annual rainfall reaches the ground (Johnson 2012). Another 40 to 48 inches per year (100 to 120 cm per year) of water is lost to evapotranspiration in limestone forests (*Note*: average annual rainfall for the project area is 90 to 105 inches [230 to 270 cm]) (USGS 2012). The numerical groundwater model developed by the USGS accounts for projected changes in land use in determining future recharge rates and allows for modifications in groundwater pumping, as necessary (*Note*: an approximately 1% increase in groundwater recharge rates were estimated for future conditions associated with the 2010 Final EIS where greater areas of limestone forest would be removed and converted to impervious area as compared to Alternative A [USGS 2012]). In addition, these changes in land cover and impervious area were accounted for during the development of a conceptual level of design for grading, drainage, and LID measures. Specifically, the project would be designed to provide required groundwater recharge rates based on 1.5 inches (3.8

cm) of precipitation from all impervious surfaces (per *CNMI and Guam Stormwater Management Manual* [Horsley Witten Group, Inc. 2006]).

Under Alternative A, proposed operations would also be in compliance with the stormwater runoff protection measures identified above that would also serve to protect groundwater quality. Specifically, the selection, location, and quantification of the appropriate LID features would be determined relative to the outcome of the capture-and-treat runoff volume calculations. The primary goal of the application of LID measures was to utilize available earthen areas to capture the 95th percentile runoff volume. These capture-and-treat features would be strategically placed to enhance planted areas for the benefit of optimizing stormwater treatment and infiltration, offering the additional benefit of reducing turf management, avoiding foot traffic erosion, and improving multifunctional opportunities. Implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that the stormwater flowing into infiltration basins and recharging the aquifer would be of acceptable quality.

Conveyance of stormwater runoff would occur in vegetative channels and bio-retention cells located at strategic points within those swales, providing the necessary treatment prior to discharging into the detention ponds and from the site (see Appendix F for examples of LID applications that would be used). The detention/retention ponds would also provide water quality treatment through extended detention for up to the 25-year design storm. These measures would collectively meet the water quality requirements and provide treatment for all stormwater runoff up to the 100-year design storm event prior to discharging to sinkholes.

Groundwater Extraction. Under all cantonment/family housing alternatives, increases in groundwater withdrawals to meet potable water demand would drop from an estimated daily average of 5.8 MGd (22.0 MLd) anticipated in the 2010 Final EIS to 1.7 MGd (6.4 MLd) under the 2012 Roadmap Adjustments. This 1.7 MGd (6.4 MLd) represents the estimated average daily potable water demand associated with the steady state operations of the relocated Marines with the assumption that all housing units are occupied. To meet the demand under the 2012 Roadmap Adjustments, the proposed action would require installation of approximately 11 new wells, which would be located at AAFB regardless of the cantonment/family housing alternative. The determination of 11 new wells is based on the estimated maximum day demand of 2.6 MGd (9.8 MLd), in accordance with DoD standard criteria. As noted under construction impacts, the wells would be sited in accordance with Guam regulations to ensure that they would not produce contaminated water.

Implementation of sustainability practices (i.e., water conservation measures via Leadership in Energy and Environmental Design) would reduce the amount of groundwater required, which would help minimize direct impacts to groundwater availability. Conservation measures may include, but would not be limited to: low flow fixtures, low flow urinals, recycling vehicle wash rack water, rain water harvesting, and xeriscape (landscaping requiring no irrigation). The applicable DoD criteria for analyzing water demands do not stipulate a methodology for estimating demands during a drought period. The GWRDG would identify operational adjustments to be implemented during periods of drought. In practice, all water system owners would implement and enforce water conservation measures to manage demands during drought periods.

In addition to potable water demand generated under Alternative A, organic civilian population growth independent of the proposed action is estimated to result in an average daily long-term increase in water demand of 3.5 MGd (13.2 MLd). The demand from organic civilian growth would be satisfied by the GWA system, primarily from the NGLA, but also from surface water in southern Guam. The forecast

water demand does not peak during construction as it would have under the proposed action in the 2010 Final EIS due to the reduced number of imported construction workers. The forecast water demand increases steadily through year 2028 due to the impact of induced and organic civilian growth. Total average daily water extraction from the NGLA from all sources (DoD water system, GWA water system, and a few private wells) is estimated to be 47.0 MGd (177.9 MLd) in year 2028 (USGS 2013a). With proper management, this quantity is within the sustainable yield of 80.5 MGd (304.8 MLd) estimated by GovGuam (1992) (USGS 2013a).

As discussed in Section 4.1.2.1 of this SEIS, the USGS has developed a numerical groundwater model as a tool to assist water resource managers in estimating the effects of selected groundwater pumping and climate scenarios on the water supply. The numerical groundwater model is being used to estimate the regional effects to groundwater availability from various withdrawal and recharge scenarios that included the increased withdrawal due to the proposed action and all other known future DoD actions, as well as organic growth of the Guam civilian population. The results from the model would assist water-resource managers to plan, design, and manage water systems that would produce a sustainable and reliable freshwater supply (USGS 2013b). The results of the USGS study confirm the recharge rate of the NGLA used in the GovGuam (1992) study but indicate that increased withdrawal from the NGLA may result in higher levels of chloride concentrations as compared to the 2010 base year scenario (USGS 2013c). The model indicates that these chloride concentration spikes would be a localized phenomenon, in which simulated salinity levels (i.e., measured by chloride concentration) in three wells (two GWA and one DoD) in the Finegayan basin moved into the cautionary subclass. However, by redistributing withdrawal rates among the extraction wells, it could be possible to meet the water demands and maintain acceptable salinities over all existing and proposed GWA and DoD wells. As discussed in Section 4.1.14, Utilities, there are connection points within the DoD water system where water can be supplied to GWA if needed.

The USGS model does have limits due to uncertainties regarding the actual conditions within the aquifer. As more data become available for inclusion in the model, the reliability of results can be improved. The USGS and WERI have identified that the rehabilitation and expansion of the hydrologic data collection network and monitoring would be necessary to ensure sustainable management of the NGLA (USGS 2013c). Specifically, this would require rehabilitation of 12 existing deep monitoring wells, placement of seven additional deep monitoring wells in basins with little or no monitoring coverage, closure of one existing monitoring well, relocation of one existing monitoring well due to proposed widening of Route 3, and establishment of a periodic maintenance program (USGS 2013c).

Based on the above, the operation phase of Alternative A could result in short-term, localized significant impacts to the affected basin within the NGLA but less than significant impacts to the overall NGLA. The significance of groundwater impacts resulting from implementation of Alternative A would be similar to that associated with implementing Alternatives B, C, D, and E. As potential mitigation for the localized significant impact, the DoD would, as appropriate, implement enhanced water conservation measures for the proposed action, improve existing water systems to reduce system leaks, adjust pumping rates at DoD wells, use existing wells, and/or increase the use of surface water from Fena Reservoir to reduce withdrawals from the NGLA.

The DoD is committed to supporting the GWRDG and to regularly meeting to manage the aquifer for the good of all users. To ensure sustainable management of the NGLA, DoD supports USGS's recommendation on expansion of the hydrologic data collection network and monitoring, including rehabilitation and expansion of current water-resource monitoring in the NGLA, as well as placement of

additional deep monitoring wells to allow monitoring by basins, and identify possible funding solutions and the role DoD will play in this process.

As required in the FY 2014 NDAA, the EAC implementation plan will address public infrastructure requirements necessary to support the preferred alternative, as well as address groundwater-related issues including technical and financial assistance for an updated and expanded NGLA monitoring well network and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the NGLA monitoring well network. To support this implementation plan, DoD assessed GWA's water and wastewater systems that may be affected by the preferred alternative. The water and wastewater assessment recommended an updated and expanded NGLA monitoring well network and refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

Therefore, the groundwater model, along with an improved network of wells to monitor groundwater levels and water quality, would be used to sustainably manage the NGLA. As part of the GWRDG, the USGS and WERI would conduct periodic monitoring of the aquifer groundwater chemistry to optimize the system and DON or GWA could adjust pumping rates if chloride levels show an increase. This would ensure increased pumping does not adversely affect military or non-military sources of potable water. Monitoring the chloride concentrations in the basins and maintaining the capability to shift pumping to wells further from impacted basins if high chloride concentrations are detected, would reduce potential negative short- and long-term impacts on the groundwater resource. This approach would also allow adjustments in pumping to address changes in precipitation patterns due to climate change or long-term drought.

Groundwater Quality

During operations, additional wastewater flow from the cantonment and family housing at Finegayan would utilize the existing GWA interceptor sewer along Route 3 to the Northern District WWTP. This increased flow would accelerate the deterioration of the existing reinforced concrete sewer pipes. Failure of these sewer lines could negatively impact the quality of the groundwater through increased spills and leakage. This impact on groundwater is significant but mitigable by rehabilitation or replacement of the existing sewer pipes.

Summary. Given stormwater runoff protection measures (i.e., implementation of LID and pollution prevention plans); implementation of water conservation measures; groundwater demand from the NGLA that would be substantially less than the sustainable yield; improved management of the NGLA through use of the numerical groundwater model; DoD assistance in identifying funding through the EAC process for an updated and expanded monitoring network; and other potential mitigation measures discussed above, operations associated with Alternative A would result in less than significant impacts to the overall NGLA; short-term, localized significant but mitigable impacts from groundwater extraction to the affected basin within the NGLA; and significant but mitigable impacts to groundwater quality from increased flow in the deteriorating GWA interceptor sewer system.

Nearshore Waters

Under Alternative A, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would ensure that there would be no increase in off-site transport of stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event. In addition, the vegetative cover between the housing area and the cliff edge and Haputo Bay would provide additional buffer and protection from stormwater runoff or sediment reaching Haputo Bay. Therefore, there would be no direct impacts to nearshore waters from stormwater runoff associated with increased impervious areas under Alternative A.

Operation of the cantonment and family housing facilities under Alternative A would result in a significant but mitigable impact to nearshore waters from increased wastewater discharge from the Northern District WWTP outfall. The Northern District WWTP is non-compliant with the treatment standards required by its current NPDES permit and increasing the wastewater discharge from a non-compliant treatment plant would be a significant indirect impact during the period of non-compliance. The nearshore waters impact resulting from implementation of Alternative A would be similar to that associated with implementing Alternatives B, C, D or E. However, upgrades to bring the Northern District WWTP into compliance with the permit are expected to be completed early in the operational phase of the proposed action and such upgrades would mitigate the impact to a less than significant level.

Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate significant impacts to nearshore waters once the upgrades are completed. In addition, refurbishing the main GWA sewer lines from AAFB to the Northern District WWTP along Routes 3 and 9 would mitigate potential failure of the concrete reinforced sewer lines that are in a state of deterioration. The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. The water and wastewater assessment that DoD prepared to support the Implementation Plan recommended upgrades to the Northern District WWTP and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

Wetlands

No wetlands are located in or near the proposed operational areas under Alternative A. Therefore, operations associated with Alternative A would result in no impacts to wetlands.

4.1.3 Air Quality

4.1.3.1 Affected Environment

Under Alternative A, the affected environment for Air Quality, including revisions of air quality regulations and air quality information specific to Guam, is the same as described in Section 3.1.3 of this SEIS, with further details provided in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.1: Affected Environment, pages 5-1 to 5-14).

According to the current USEPA designation, Guam is in attainment for all criteria pollutants with the exception of two areas near power plants that remain in nonattainment for the SO_2 NAAQS (see 2010 Final EIS, Volume 2, Chapter 5: Air Quality, Section 5.1: Affected Environment, Figure 5.1-1):

- Piti - Portion of Guam within a 2.2-mile (3.5-km) radius of the Piti Power Plant.
- Tanguisson - Portion of Guam within a 2.2-mile (3.5-km) radius of the Tanguisson Power Plant.

The area covered by Alternative A at Finegayan is outside of these two nonattainment areas.

On-island major stationary sources, as described in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.1.1.2 Stationary Sources, Page 5-5) continue to be operated under the current Title V permits. The air quality ROI in the northern area of the island where Alternative A is located would continue to be affected by those major stationary source operations.

Major highway traffic along Routes 1, 2, 3, 5, 9, and 15 remains the dominant island-wide source of mobile source emissions. Route 3 is the closest highway to Finegayan.

As discussed in Section 3.3.3.1, since the publication of the 2010 Final EIS, GEPA, under the Air Pollution Control Program, has worked closely with businesses and the Guam Legislature to help the island transition to ultra-low sulfur diesel. Since January 1, 2011, all diesel fuels sold on Guam meet ultra-low sulfur diesel quality standards.

Air quality conditions at Finegayan are affected predominantly by on-road mobile sources and aircraft operations around AAFB, with limited exposure to other sources. At Finegayan, the major sources that the DON is currently permitted to operate, under the Title V permit, include three diesel emergency generators with a combined capacity of 7.5 MW and two 5.23 million British thermal units per hour boilers fired using No. 2 oil. However, the two boilers are no longer in operation. Total permitted emissions for the sources at Finegayan are presented in Table 4.1.3-1.

Table 4.1.3-1. Finegayan—Permitted Emissions

Permitted Annual Emissions (tpy)				
SO_2	***CO***	***PM_{10}***	***NO_x***	***VOC***
106.9	43.0	5.9	187.4	5.5

Legend: tpy = tons per year; SO_2 = sulfur dioxide; CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter (<10 microns); VOC = volatile organic compounds.
Source: USEPA 2013.

Major highway traffic along Route 3 remains the dominant source of mobile source emissions for Alternative A. Sensitive populations in the vicinity of this site are mostly located along major traffic routes, such as Route 3.

4.1.3.2 Environmental Consequences

Construction

Annual Emissions

Direct emissions for criteria pollutants and CO_2 from short-term operation of on-site equipment and vehicles during construction (2016 through 2022) were estimated based on the acreage of disturbed earth and the number and type of facilities to be constructed. Given limited preparation activities anticipated in 2016, construction emissions are considered negligible and were not quantified for that year. The short-term direct emissions would be well below the impact significance criterion of 250 tpy for criteria pollutants, as shown in Table 4.1.3-2. The CO_2 emissions during construction period would be less than

those analyzed in the 2010 Final EIS resulting in less GHG impacts as compared to the No-Action Alternative.

Table 4.1.3-2. Finegayan Cantonment/Family Housing Annual Construction Emissions (2015-2022)

	Construction	***Pollutant (tpy)***						
	Year	***SO_2***	***CO***	***PM_{10}***	***$PM_{2.5}$***	***NO_x***	***VOC***	***CO_2***
Alternative A	2016	neg	neg	neg	neg	neg	neg	neg
	2017	0.0	0.6	0.0	0.0	0.4	0.1	96.2
	2018	0.3	20.1	1.2	1.1	15.6	2.1	3,445.4
	2019	0.6	36.5	2.2	2.0	28.2	3.8	6,247.3
	2020	0.2	9.5	0.6	0.5	7.3	1.0	1,621.3
	2021	0.8	45.9	2.8	2.5	35.5	4.7	7,855.2
	2022	0.2	13.6	0.8	0.7	10.5	1.4	2,324.4

Legend: SO_2 = sulfur dioxide; CO = carbon monoxide; PM_{10} = particulate matter (<10 microns); $PM_{2.5}$= particulate matter (<2.5 microns); NO_x= nitrogen oxides; VOC= volatile organic compounds; CO_2 = carbon dioxide; neg = negligible.

On-Site Equipment and Vehicle PM Hot-Spot Analysis

Based on the same construction activity data developed and used for the annual emissions estimates, the on-site emissions generated over the maximum potential adverse effect month were conservatively assumed, for modeling purposes, to be both evenly distributed over the construction area and to occur over the entire year. The housing areas across Route 3 are considered the most sensitive to potential impacts from the proposed construction activities because of the close proximity to the cantonment construction sites.

The emission sources analyzed include non-road equipment and trucks. Specific on-site construction information used to calculate emissions generated from construction activities includes the following:

- Number and type of construction equipment to be used.
- Fuel type used for the construction equipment (all equipment assumed to be diesel-powered).
- Equipment usage rates (hours per day).
- Equipment load factors (a percentage of the maximum horse power).
- Average speed of all construction equipment and delivery vehicles.
- Average vehicle miles traveled on-site by diesel construction equipment.

The on-site non-road equipment and vehicle PM hot-spot impact analysis consisted of the following:

- *Estimation of PM emissions generated by construction activities and truck trips on a monthly and annual basis for the entire construction period, and the determination of the emissions in the maximum potential adverse effect month/year condition to be used for further dispersion modeling.* Detailed construction schedule plan will be available once the project progresses. Therefore, at this SEIS planning stage, the worst-case short-term (24-hour average) and long-term (annual average) emissions were evenly distributed over the proposed cantonment activity areas assuming construction would occur at the same year in those activity areas as shown in Figure 4.1.3-1.

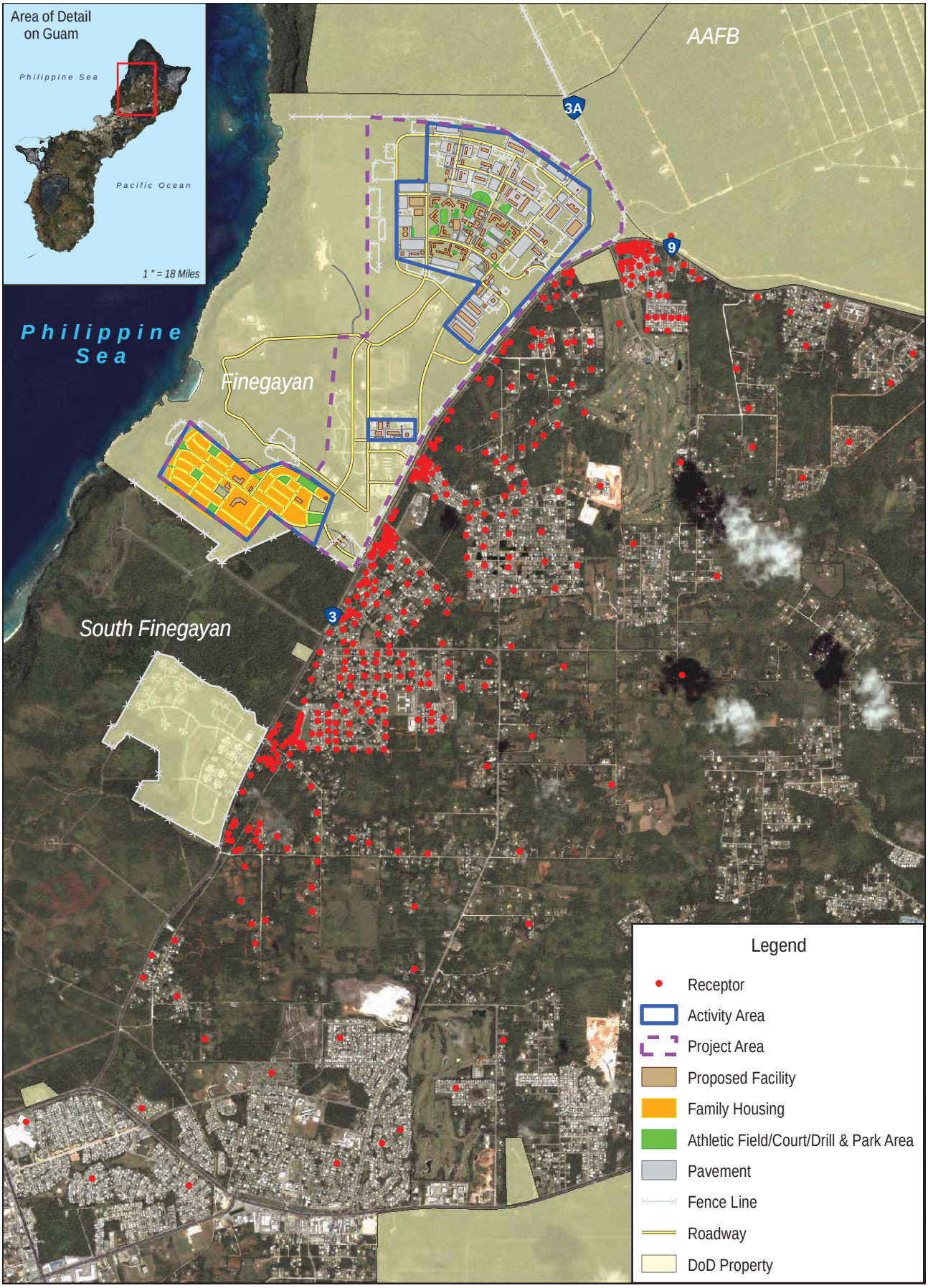


Figure 4.1.3-1

PM Modeling Configuration - Alternative A

- *Estimation of maximum PM concentration levels at sensitive receptor sites located near the cantonment/housing site to determine whether the PM NAAQS would be exceeded as a result of construction activity.* The PM concentration levels were predicted using the AERMOD dispersion model in association with the most recent 5-year Guam meteorological data. The same modeling procedures discussed in the 2010 Final EIS for the stationary source impact modeling were employed in this analysis. Table 4.1.3-3 shows the predicted total worst-case concentrations for PM (PM_{10} and $PM_{2.5}$) from the contributions of (1) on-site construction activities, and (2) worst-case off-site location on-road vehicle exhausts evaluated below in addressing potential MSAT impacts. The total PM levels predicted are well below respective NAAQS, resulting in less than significant direct, short-term PM impacts during construction years.

Table 4.1.3-3. Total Construction Period PM Concentrations Finegayan Cantonment/Family Housing Alternative A

Source Contributions	*24-hour Average PM_{10} ($\mu g/m^3$)*	*24-hour Average $PM_{2.5}$ ($\mu g/m^3$)*	*Annual Average $PM_{2.5}$ ($\mu g/m^3$)*
On-site Construction Activity	1.01	0.60	0.02
Off-site Mobile Source[1]	0.47	0.47	0.12
Total	**1.48**	**1.07**	**0.14**
NAAQS	150	35	12

Note: [1]Based on the worst-case modeling results for total diesel particulate concentrations performed as part of off-site MSAT analysis.

Off-Site On-Road Vehicle Hot-Spot Analysis for CO

The same CO screening evaluation that was conducted for the 2010 Final EIS was performed on the 65 intersections identified in the project area as the most congested and most affected under this alternative, including the worst-case scenario (i.e., Alternative D) under the worst-case construction year. Out of the 65 intersections, six worst-case intersections among those failing the screening were chosen for detailed analysis due to poor levels of service, high volumes, close proximity to sensitive receptors, and geographical representation. These six selected intersections are listed below in Table 4.1.3-4.

CO concentration levels were predicted using CAL3QHC in association with the emissions factors predicted by MOVES. These predicted concentration levels were then added to the background levels to determine the total hot-spot concentration levels for construction and operation years. Table 4.1.3-4 shows the total concentrations for CO in comparison to the respective NAAQS. The predicted levels are well below the NAAQS, resulting in less than significant direct short-term CO impacts.

Table 4.1.3-4. Predicted Worst-Case CO Concentrations (ppm)

Site #	*Site Description*	*Construction*		*Operation*	
		1-hour	*8-hour*	*1-hour*	*8-hour*
1	Route 3/9/Chalan Santa Anita	2.4	2.3	2.3	2.2
2	Route 1 / Route 3	3.6	3.1	3.4	3.0
3	Route 16 / Route 27	3.0	2.7	3.0	2.7
4	Route 1 / Route 14A	3.8	3.3	3.7	3.2
5	Route 10 / Route 15	2.9	2.6	2.9	2.6
6	Route 1 / Route 2A	2.5	2.4	3.0	2.3

Notes: 1-hour NAAQS = 35 ppm and 8-hour NAAQS = 9 ppm.
Source: GDPW 2013.

Off-Site On-Road Vehicle Hot-Spot Analysis for PM

As discussed in Chapter 3.3, PM hot-spot analysis began with a screening diesel percentage evaluation per 40 CFR 193. As shown in Table 4.1.3-5, the future worst-case construction year annual average daily traffic of the roadways within the study area are well below the USEPA defined screening threshold of 125,000 annual average daily traffic and 8% diesel truck traffic, which equates to 10,000 trucks. Therefore, a further hot-spot dispersion modeling analysis using AERMOD or CAL3QHCR is not warranted and there would be no PM hot-spot concerns along the affected roadway network. Direct, short-term impacts would be less than significant.

Table 4.1.3-5. Annual Average Daily Traffic, Heavy Vehicle Percentages, and Number of Heavy Vehicles on Roadways within the Study Area

Route	Segment	Construction			Operation		
		Annual Average Daily Traffic	Heavy Vehicles	Number of Heavy Vehicles	Annual Average Daily Traffic	Heavy Vehicles	Number of Heavy Vehicles
Route 1	South of Route 6	26,268	2.70%	709	27,167	2.42%	656
Route 11	West of Route 1	4,159	20.82%	866	3,431	13.95%	479
Route 1	West of Route 7	31,363	5.01%	1,571	31,673	3.61%	1,144
Route 4	North of Route 7A	22,289	2.09%	466	23,692	2.11%	501
Route 1	East of Route 4	49,650	3.27%	1,624	49,533	2.47%	1,222
Route 8	West of Chalan RS Sanchez	27,253	1.33%	362	28,510	1.19%	340
Route 16	Between 8 and 10A	35,494	1.73%	614	32,326	1.72%	556
Route 27	Between Route 16 and Route 1	27,589	1.28%	353	35,985	1.32%	475
Route 1	North of Pale San Vitores Road	54,303	2.96%	1,607	47,664	2.31%	1,101
Route 16	South of Route 1	23,207	2.37%	550	24,355	2.36%	576
Route 3	North of Route 1	27,377	3.85%	1,054	25,781	1.43%	368
Route 1	East of Route 28	35,272	3.18%	1,122	35,958	2.68%	965
Chalan Lujuna	Between Route 1 and Route 15	7,688	21.62%	1,662	5,092	3.34%	170
Route 1	South of AAFB	24,008	7.78%	1,868	21,179	2.36%	500
Route 9	North of AAFB	13,558	11.68%	1,584	10,774	2.17%	234
Route 15	South of Chalan Lujuna	7,816	6.65%	520	7,657	2.64%	202
Route 1	North of Route 14A	70,263	3.40%	2,389	70,097	2.85%	2,000

Source: GDPW 2013.

Off-Site On-Road Vehicle Hot-Spot Analysis for MSATs

MSATs concentration levels were predicted using CAL3QHC in association with the emissions factors predicted by MOVES. The screening-level MSAT dispersion modeling analysis was conducted at sensitive (actual) and sidewalk receptors for 2021 and 2030, which represent the peak construction year and the design year, respectively. The analysis was conducted for both a 30-year exposure and a longer, more conservative exposure duration of 70 years for cancer risks.

Maximum estimated increases in cancer risk at any of the receptors due to the project, as shown in Table 4.1.3-6, are all less than the threshold criterion of 10 in a million. Therefore, the direct, short-term impacts of all carcinogenic MSATs are considered acceptable and would be less than significant.

The maximum chronic hazard index at any of the receptors due to project emissions are well below the target limit of 1, as shown in Table 4.1.3-7. Therefore, the direct, short-term impacts of all non-carcinogenic MSATs are considered acceptable and would be less than significant.

Table 4.1.3-6. Estimated Project Related Impacts Compared to Target Cancer Risk Threshold

	30-Year Estimated Cancer Risk Increase ($x10^{-6}$)		*70-Year Estimated Cancer Risk Increase ($x10^{-6}$)*		*Target Cancer Risk Threshold*
	Construction	*Operation*	*Construction*	*Operation*	
Sensitive Receptors					
Route 3/9/Chalan Santa Anita	0.147	0.023	0.353	0.056	10[1]
Route 1 / Route 3	0.032	0.012	0.076	0.028	
Route 16 / Route 27	0.041	0.006	0.098	0.015	
Route 1 / Route 14A	0.011	0.002	0.026	0.005	
Route 10 / Route 15	0.002	0.010	0.004	0.023	
Route 1 / Route 2A	0.011	0.001	0.027	0.002	
Sidewalk Receptors					
Route 3/9/Chalan Santa Anita	0.075	0.037	0.180	0.088	10[1]
Route 1 / Route 3	0.035	0.030	0.084	0.071	
Route 16 / Route 27	0.033	0.007	0.078	0.016	
Route 1 / Route 14A	0.037	0.008	0.089	0.019	
Route 10 / Route 15	0.070	0.125	0.168	0.300	
Route 1 / Route 2A	0.024	0.003	0.057	0.006	

Note: [1]Target threshold is 10 excess cancer cases in a million.
Source: GDPW 2013.

Table 4.1.3-7. Estimated Project Related Impacts Compared to Target Hazard Index

Analysis Receptor	*30-Year Estimated Non-Cancer Chronic Hazard Index - Sensitive Receptors*		*30-Year Estimated Non-Cancer Chronic Hazard Index - Sidewalk Receptors*		*Target Hazard Index*
	Construction	*Operation*	*Construction*	*Operation*	
Route 3/9/Chalan Santa Anita	.030	0.003	0.015	0.005	1[1]
Route 1 / Route 3	.008	0.002	.012	0.004	
Route 16 / Route 27	.015	0.001	.013	0.001	
Route 1 / Route 14A	.003	0.000	.011	0.001	
Route 10 / Route 15	.005	0.002	.018	0.018	
Route 1 / Route 2A	.004	0.000	.007	0.001	

Note: [1]Target hazard index indicates that exposure is below concentrations associated with adverse effects.
Source: GDPW 2013.

Operation

The hot-spot impact analyses of off-site on-road vehicle CO, PM, and MSATs emissions during operational years were conducted using the same methods described above for the construction phase year condition. The analysis results are summarized in Table 4.1.3-4 for CO, Table 4.1.3-5 for PM, and Tables 4.1.3-6 and 4.1.3-7 for carcinogenic and non-carcinogenic MSATs, respectively. The long-term, direct impacts of these pollutants on air quality would be less than significant.

4.1.4 Noise

4.1.4.1 Affected Environment

Aircraft Noise

The 2013 AAFB AICUZ Study (Pacific Air Force 2013) noise levels at and in the vicinity of AAFB are used to characterize the baseline noise environment. Figure 4.1.4-1 shows the 65-69, 70-74, 75-79, 80-84, and 85+ dBA DNL noise contours from the 2013 AAFB AICUZ and Table 4.1.4-1 lists the corresponding amount of affected area.

Table 4.1.4-1. 2013 AICUZ Noise Contour Off-Base Acreage in the Vicinity of AAFB

Noise Level (DNL)	*Area Affected (acres [ha])**
65-69 dBA	689 (279)
70-74 dBA	117 (47)
75-79 dBA	16 (7)
80-84 dBA	0
>85 dBA	0
Total	**822 (333)**

Notes: *Acreages, including totals, may not correspond exactly due to rounding. Only includes acreage over land.
Source: Pacific Air Force 2013.

In the vicinity of Finegayan, noise contours caused by AAFB aircraft operations do not extend to Finegayan and are below 65 dBA. Residents along Route 3 experience aircraft noise of less than 65 dBA under baseline conditions.

Non-Aircraft Operations

Current operational activities at the Finegayan communication site include the operation and maintenance of communication equipment, antennae, and infrastructure. An exchange, gas station, and gymnasium are among the few community service facilities currently on Finegayan. Training at the existing rifle and pistol small arms range on the west side of Finegayan generates the only appreciable operational noise, but the range is small and small arms are fired in the opposite direction of the existing receptors along Route 3. Sensitive receptors can be residences, churches, and schools but near Finegayan all of the sensitive receptors are residences with the Route 3 frontage.

Traffic

As described in the 2010 Final EIS (Volume 2, Chapter 6: Noise, Section 6.1.2.4: Off-Base Roadways, pages 6-11 and 6-13 to 6-15), baseline traffic noise along Route 3 was estimated using short- and long-term noise monitoring and noise measurements taken in March 2009. Long-term monitoring determined the highest noise levels during peak traffic hours (7:00 a.m., 2:00 p.m., and 5:00 p.m.), and short-term monitoring measured non-peak traffic noise (4:20 p.m.). Existing 1-hour noise levels in Dededo around Finegayan was measured at 68 dBA $L_{eq(h)}$. Short-term off peak monitoring measured 54.9 dBA. Adjusting for peak noise would yield a noise level of 55.9 dBA, which would be more representative of the equivalent noise levels throughout the course of an entire day.

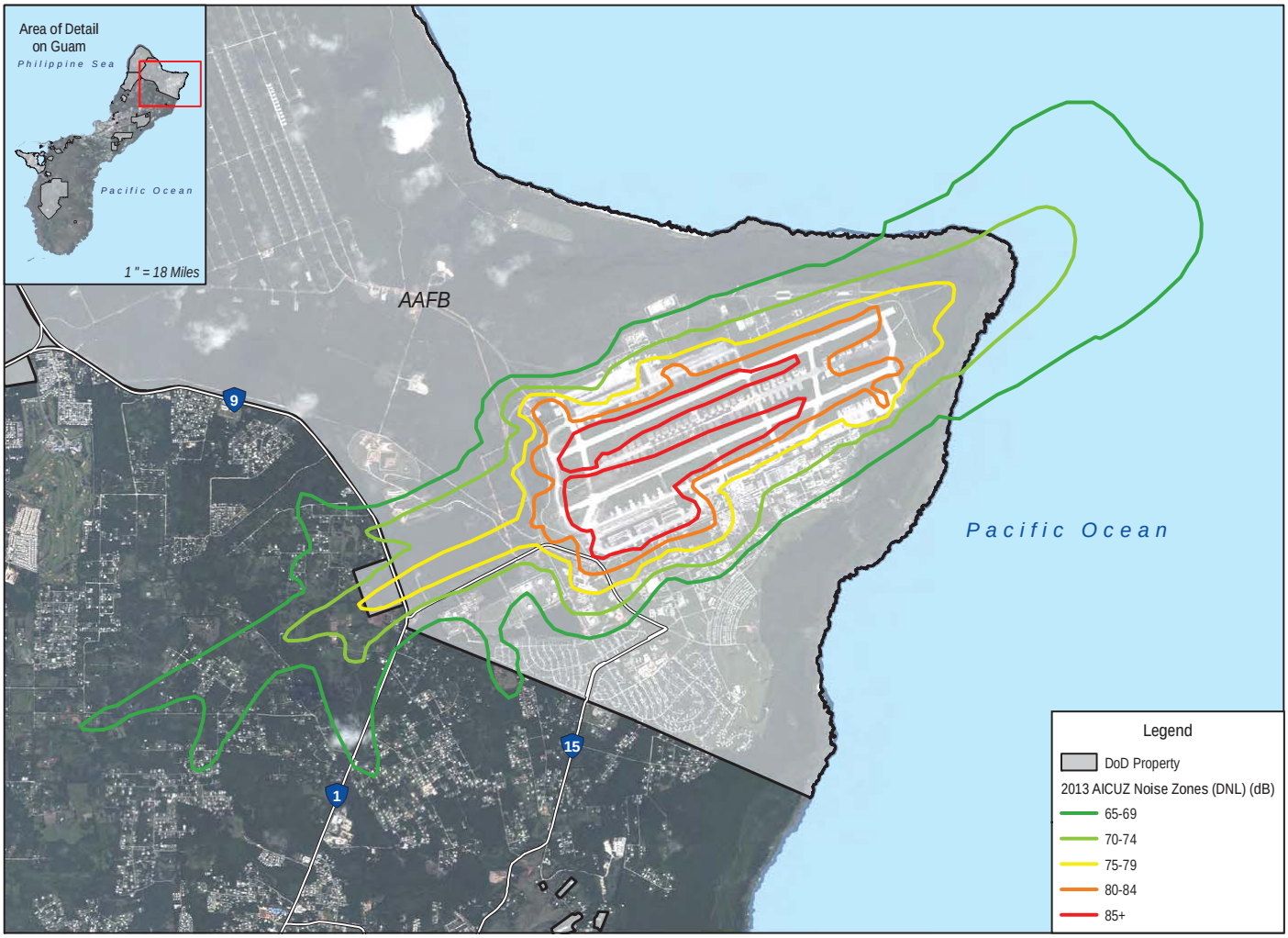


Figure 4.1.4-1
Existing AAFB Noise Contours

4.1.4.2 Environmental Consequences

Construction

As described in Section 2.4.4.1, the cantonment area and family housing proposed for construction at Alternative A would include various facilities, roadways and infrastructure to support the Marine Corps relocation to Guam, and associated construction activities would result in noise impacts on the surrounding environment. In addition, construction activities associated with off-site utilities development and DoD school expansions would also generate noise. Construction activity noise varies with the types of equipment used and the duration of use. Heavy equipment and other construction activities generate noise levels ranging typically from 70 to 90 dBA at a distance of 50 feet (15 m). During facilities construction, use of heavy equipment commonly occurs sporadically throughout the daytime hours.

This analysis considers both short-term and long-term construction activities. Short-term activities would be construction near the base boundary specifically affecting the nearest receptors. Long-term would be generalized construction activities centered in the middle of the area lasting the entire duration of all construction projects. Generally, heavy equipment would generate the highest noise levels throughout the construction phase, but the noise would be short-term in nature, and would diminish the farther sensitive noise receptors are from the construction activity. Construction activities would be spread out for many years, but individual projects only affect the receptors adjacent to the project and projects located on the other side of the property would not affect those receptors. From a localized point of view for construction noise, activities generating noise at a specific receptor would only last a fraction of the total construction period and be considered a short-term event of typically less than 1-2 years for an individual project. Although some heavy equipment would be used throughout the construction process, the noisiest heavy equipment would be associated with site preparation up to and including installation of foundations. The types of equipment necessary for site preparation would be graders, pavers, dump trucks, and concrete mixers and their use would diminish as construction of the structures begins. Use of heavy equipment also depends on the construction schedule, and its use would not be permanent. For noise calculation purposes, it is assumed that 10 pieces of heavy equipment including multiple graders, excavators, dump trucks and pavers would be used simultaneously at points nearest to the closest receptors. Using multiple pieces of equipment operating simultaneously in the same locations yields a maximum potential adverse effect for noise impact assessment. Under normal working conditions, equipment would be dispersed around the job site, dispersing the noise levels and lessening the off-base noise levels. Furthermore, the construction schedule for these Roadmap Adjustments would be spread out. Sequencing work tasks and allowing only one or two pieces of heavy equipment to operate in areas close to the nearest receptors would result in a reduction of noise impacts.

Receptors that might be affected by Alternative A construction noise would comprise approximately 20 houses along Route 3 across the road from the proposed cantonment/family housing location. According to the Guam Bureau of Statistics, the average household size in the area is 3.67 people per household (GBSP 2010), thus it is estimated that about 70-75 people could be affected by implementation of the proposed action.

Short-term construction noise for this alternative would result from noise-producing activities in the immediate vicinity of residential receptors along Route 3. The closest proposed construction activity for this alternative would occur approximately 500 feet (152 m) from the average receptor, with Route 3 frontage and noise levels estimated to be 65.4 dBA L_{eq}. Short-term increases in truck traffic used to transport materials on- and off-site would also produce noise disturbance of approximately 65 to 70 dBA L_{eq} within and near the construction corridors. Again, this would produce short-term, localized noise for

brief periods, but it would not create any permanent, adverse direct or indirect noise impacts to human health or the local environment.

Under this proposed action, construction activity would occur over a longer duration compared to the more compressed construction schedule described in the 2010 Final EIS. Although the overall construction schedule would occur over approximately a ten-year span, individual receptors along Route 3 would not experience high levels of construction activity adjacent to the property boundary throughout the entire construction period. Given the short-term nature of construction work and lower intensity of the proposed construction activity spread over time, minimal to negligible direct impacts from construction noise are expected to result. In addition, direct short-term noise impacts would be less than significant because none of the houses along Route 3 would be close enough to experience noise exposure exceeding 75 dBA per USEPA guidelines (USEPA 1974).

Long-term construction noise impacts would result from noise generated throughout the entire duration of construction. For Alternative A, three different locations are analyzed: residences along Route 3, the center of the cantonment area, and the center of the family housing area. From the perspective of an individual receptor along Route 3, noise levels above 65 dBA would be considered incompatible for long-term land-use noise exposure. Given the equipment list previously evaluated, construction activity would need to be within 525 feet (160 m) of the receptor to generate noise levels above the 65 dBA FICUN threshold. This level is also considered the limit for annoyance. The impacted area at this distance comprises a very small percentage (<1%) of the total construction area, and would actually be considered short-term noise exposure because it would not remain at a consistent level for the entire 10-year period. Therefore, from this perspective, direct, long-term noise impacts from construction within the 525 feet zone (160 m) would less than significant.

Long-term construction noise impacts can also be addressed by modeling noise levels at the center of the cantonment area. In this scenario, construction noise represents a concentrated noise source that generates an average noise level throughout the 10-year construction period. In this case, the distance to the edge of the boundary is 2,500 feet (762 m), and if the amount of noise-generating construction equipment doubled in number, noise levels would be 54.5 dBA. This level is well below the FICUN level and meets the USEPA goal for an outdoor noise level of 55 dBA. Long-term direct and indirect noise impacts would be less than significant.

Another noise assessment perspective involves estimating noise from the center of the family housing area. In this case, the center of construction would be 3,500 feet (1,166 m) and the noise level would be 51.5 dBA and below the FICUN level and the USEPA goal for outdoor areas. Direct and indirect long-term noise impacts from construction activities for family housing would be less than significant.

Construction activities common to all alternatives also include off-site utilities and school expansions. Off-site utility construction would cause elevated noise levels but would be localized only in the immediate area of construction and would only affect receptors for a short time. The DoDEA High School expansion project would not be adjacent to any sensitive receptors and would not generate any noise impacts. The Andersen Middle School expansion and/or the elementary school construction would occur on-base and not cause construction noise impacts to off-base receptors. Andersen Middle School lies between the 65-70 dBA DNL AAFB aircraft noise contours. The design and construction of the Andersen Middle School expansion would be in accordance with the applicable noise reduction standards outlined in the American National Standards Institute, Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools (American National Standards Institute/Acoustical Society of

America 2009). The noise level reduction characteristics of the existing portion of the school would be determined and retrofitted as necessary to meet the standards.

Consequently, potential direct and indirect short-term noise impacts under Alternative A for construction activities at Finegayan and construction activities for facilities common to all alternatives would be less than significant because increased noise levels would be short-term and would be below USEPA guidelines of 75 dBA $L_{eq.}$

Operation

After all construction has been completed, the long-term noise generating activities at Finegayan would be primarily due to traffic. Traffic noise along Route 3 would increase but would be less than the levels described in the 2010 Final EIS (Volume 6, Chapter 8: Noise, Section 8.2.6: Off-Base Roadways, pages 8-14 to 8-15 and Volume 9, Appendix G: Chapter 6: Noise, Guam Community Build-up Figures, pages 1 to 10). Traffic noise under this alternative was estimated by comparing the increase of traffic relative to baseline for the 2010 Final EIS qualitatively and the increase of traffic due to this alternative. Using these comparisons and knowing the modeled noise levels from the 2010 Final EIS, the long-term, operational noise levels for implementation of Alternative A can be inferred. The highest noise levels along Route 3 determined in the 2010 Final EIS were 66 dBA at the nearest residences on Route 3 south of Route 28 to the intersection of Route 1. Traffic levels along that stretch of Route 3 and portions of Route 1 would be LOS "F", and compared to traffic along the same area under this alternative, the LOS would also be "F", indicating the road is beyond full capacity. Although the overall population increase would be less than predicted under the 2010 Final EIS, traffic noise would not appreciably change from the 2010 Final EIS because the road would be at full capacity (FHWA 2013). There would be no appreciable change in noise levels because an LOS of "F" is stop-and-go traffic indicative of heavy traffic. The noise levels would not change, just the duration of the levels. There would be less of an increase of population; therefore, the time of stop-and-go traffic would be less than the full buildup described in the 2010 Final EIS. However, GDPW transportation noise standards of 67 dBA would not be exceeded. There would be no new flying or range operations (and associated noise generation) at Finegayan, and long-term operation of Alternative A would not include industrial-type activities. Noise would be similar to an office park and residential setting. Consequently, direct and indirect long-term noise impacts at Finegayan would be less than significant.

4.1.5 Airspace

4.1.5.1 Affected Environment

Airspace that would be impacted by the proposed action would be the same as described in the 2010 Final EIS. As indicated in Section 3.1.5 of this SEIS, designated airspace is associated with Guam International Airport and AAFB. Characteristics of the airspace have not changed since the 2010 Final EIS. Operations and functions associated with the cantonment/family housing facilities would consist of support, maintenance/storage, housing, and non-live fire training functions (see Section 2.2.1). No construction or operation activities would require changes to airspace. Therefore, the affected environment for airspace is only discussed in the context of the LFTRC components of the proposed action as provided in Chapter 5 of this SEIS.

4.1.5.2 Environmental Consequences

As discussed above, there would be no construction or operation activities requiring changes to airspace. Therefore, there would be no direct or indirect short- or long-term impacts on airspace from this component of the proposed action.

4.1.6 Land and Submerged Land Use

4.1.6.1 Affected Environment

The affected environment for land use associated with Alternative A is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.1: Affected Environment, pages 8-25 to 8-27), which is summarized below for reference. The proposed reduction in the number of relocating Marines and dependents under the proposed action does not alter the description of the affected environment for land use.

Figure 4.1.6-1 shows the lands and submerged lands, the area at Finegayan available for development, and the surrounding land use classifications on an aerial image. The land and submerged lands associated with the parcel are federally owned. Federal submerged lands extend the length of the Finegayan coastline. The parcel is bounded on the north by federally owned AAFB and private land along the coast. Route 3 and private lands are located to the east.

Finegayan is used primarily for communications functions. Other facilities include community support, administrative functions, and training. Training activities include existing rifle and pistol small arms range training that generates SDZs extending into the Philippine Sea. Public access to the submerged land areas within the SDZs is restricted during training exercises for safety reasons. Beach landings occur at Haputo Beach. Haputo ERA is located along the coast and the Overlay Refuge encompasses a large portion of the site. The potential impacts to these natural resource areas are addressed in Section 4.1.8, Terrestrial Biological Resources. Recreational uses of the land and submerged land are addressed Section 4.1.7, Recreational Resources.

Potts Junction is included in the proposed cantonment development area. The parcel is vacant federally owned DoD land located east of Route 3 near the intersection of Route 3 and Route 9. The adjacent existing and proposed land uses are residential.

NWF is adjacent to and north of Finegayan and the area adjacent to Finegayan is vacant open space (Figure 4.1.6-1). There is private land north of Finegayan on the coastline that is planned Park/Open Space. Important farmland is identified on the private land but it is not currently cultivated. Residential is the predominant current and planned land use east of Route 3. Village Center is the planned land use for areas east of the southern end of Finegayan and Route 3. The former FAA parcel and the Dos Amantes Hotel/Resort planned land use area are located adjacent to and south of the parcel.

4.1.6.2 Environmental Consequences

Land use impacts are addressed in this section. Land ownership impacts are addressed in Section 4.1.15, Socioeconomics and General Services.

Construction

As previously discussed in Section 3.6.3.1, Methodology, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource under any of the alternatives assessed in this SEIS.

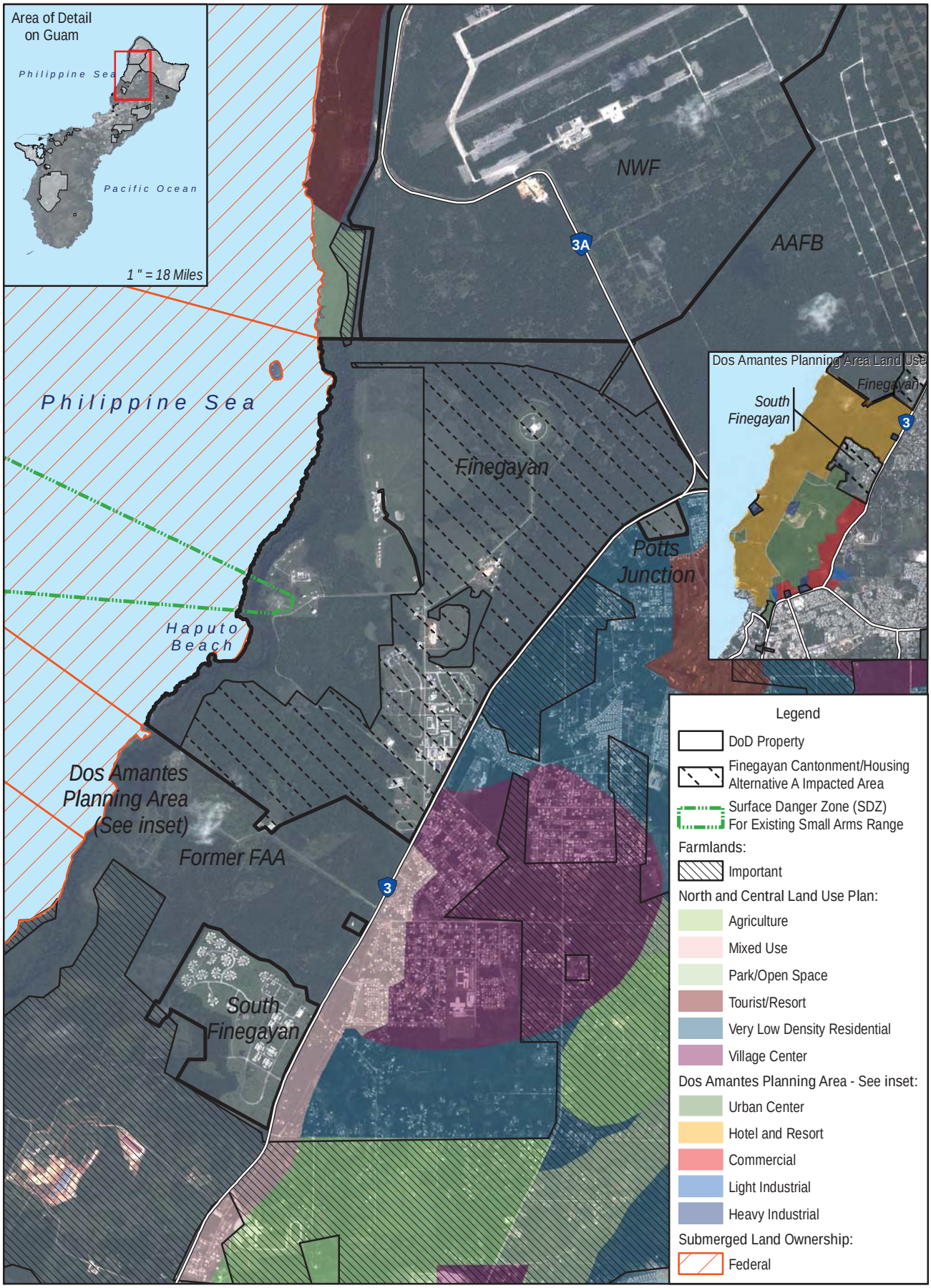


Figure 4.1.6-1
Land Use in the Vicinity of
Finegayan Cantonment/Housing Alternative A

Sources: DON 2010, NAVFAC Pacific 2013

Operation

The proposed action is generally restricted to Finegayan (see Figure 2.4-4 in Chapter 2 of this SEIS). However, there are off-base improvements (utilities and education facilities), some of which are specific to this alternative and some of which are common to all cantonment/family housing alternatives. All the alternatives would require expansion of DoDEA High School and the Finegayan alternative would also expand the Andersen Middle School. The schools are located on federal land and would be compatible with adjacent community support facilities on the installation and residential land uses in the surrounding communities. There would be no land use impacts on the surrounding communities.

No submerged lands would be affected by the proposed action.

All cantonment alternatives require water well development on AAFB. The affected environment and environmental consequences are described in Section 4.3.6 of this SEIS. The off-base utility improvements specific to this alternative (see Figure 2.4-5 in Chapter 2 of this SEIS) would be placed underground along existing roadways or within existing utility easements along Routes 3, 3A and 9. The off-base utility improvements common to all cantonment/family housing alternatives utility improvements would also be aligned along existing roadways (Routes 1, 3, and 9) (see Figure 2.4-14 in Chapter 2 of this SEIS). There would be no impact on land use resulting from the off-base utility improvements. However, additional inter-base IT/COMM connectivity would be required as described in Chapter 2. This includes the connection between AAFB and the existing Tata Cable landing facility in southern Guam, which would require new rights-of-way along some southern roads and the access road to the Tata facility.

The proposed family housing facilities would be located in the southern portion of the parcel and cantonment land uses would be central to north of the parcel.

There would be no change to the existing communications mission at Finegayan under the proposed action. Prior to the proposed military relocation, no long-term use was identified for the non-communications facilities at Finegayan. The buildings that cannot be reused in the redevelopment would be demolished. Open space would be incorporated into the cantonment/family housing plan but there would be less open space than currently exists at Finegayan, resulting in a less than significant long-term land use impact on the nearby communities beyond installation boundaries. The maximum height of the cantonment buildings would be six stories and the housing would be a maximum of two stories. All development is set back from the perimeter fencing, creating a buffer of vacant land. Redevelopment of the area as a cantonment area for the Marine Corps would be compatible with historical and current DON use.

The proposed land uses on the Finegayan and Potts Junction parcels would be compatible with existing and planned future adjacent land uses. Residential and Village Center land uses are planned on adjacent properties east of Route 3 and Finegayan, and Resort/Hotel land use is planned south of the parcel. Residential land uses are planned adjacent to Potts Junction. There would be no new access restrictions imposed on the public.

Because there would be no compatibility issues with current or planned land use, no new restrictions on public access to land or submerged land, and no change to an existing land use that is valued by the community, no impacts resulting from implementation of Alternative A were identified.

4.1.7 Recreational Resources

4.1.7.1 Affected Environment

Recreational resources at Finegayan are located primarily along the coastal area of the property and centered on the Haputo ERA. A list of recreational resources at Finegayan is provided in the 2010 Final EIS (Volume 2, Chapter 9, Recreational Resources, Section 9.1.2.2: pages 9-3 to 9-4). Comprehensive descriptions of recreational resources at or near Finegayan are also provided in the 2010 Final EIS (Volume 9, Appendix G, Chapter 1: Recreational Resources, Section 1.2.2: Finegayan and Section 1.2.3: Non-DoD Lands, pages G-1-2 to G-1-5).

Use of the recreational resources located at Finegayan is subject to the same access requirements as other on-base facilities; therefore, only installation personnel and guests are able to use the recreational resources at Finegayan. Recreational resources in the Finegayan area include hiking trails, fishing, swimming, snorkeling, and scuba diving (Lotz 2004). Off-shore recreational uses in the area are open to the public. Currently, the area immediately north of Finegayan on AAFB is the only hunting area open on federal property on Guam and is limited to archery hunting only (JRM 2013). Table 4.1.7-1 identifies the recreational resources near Alternative A.

Table 4.1.7-1. Recreational Resources within the Vicinity of Alternative A

Recreational Resource	*Public Access (Current Status)*
Trails	
Haputo Trail, Double Reef Beach Trail	Installation personnel and guests only
Dive Spots	
Double Reef	Open to public via sea access
Shark's Hole	Open to public via sea access and Tanguisson Beach
Beaches and Parks	
Guam NWR Overlay	Installation personnel and guests only

Source: DON 2010.

4.1.7.2 Environmental Consequences

Construction

The construction period pace is expected to be gradual. The construction workforce would arrive gradually, as needed, for the phased construction activities. The short-term increase of construction-related vehicles on roads may cause delays to persons accessing recreational areas. The staged construction equipment would not obstruct access to, or the use of, recreational resources, but may result in inconveniences directly to resource seekers (i.e., potential detours to be made, longer waits, and other similar nuisances). As discussed in Section 4.1.15.2, there would be a maximum estimated population increase of 1,082 persons from the off-island workers and their families. This surge in population may lead to a reduction of recreational opportunities at existing facilities as more users would compete for recreational use (e.g., competing for picnic shelters). This competition for resources would likely be worse during weekends, holidays, and the months of July through March, which experience heavier tourist traffic. The general wear and tear of the available amenities would likely be accelerated due to the presence of additional users. However, the construction of Alternative A would not substantially reduce recreational opportunities, cause substantial conflicts between recreational users, or cause substantial deterioration of recreational resources. The road to Haputo and Double Reef trailheads would remain open during construction. Therefore, less than significant direct, short-term impacts to recreational resources would be anticipated.

Operation

The impacts to recreational resources would be substantially less than the significant impacts discussed in the 2010 Final EIS (Volume 2, Chapter 9: Recreational Resources, Section 9.2.2.1: Alternative 1, North, pages 9-21 to 9-22), due to the smaller number of the Marines and dependents arriving on Guam. The rate of usage and wear and tear (deterioration) of the recreational resources would be lower than previously analyzed due to a lower number of users. Implementation of the Joint Region Marianas Access Plan, which was a commitment in the 2011 PA, would facilitate public access to recreational areas that are also cultural sites.

It is important to note that recreation is not the primary function of an ERA. One of the management objectives of the ERA management plan (contained in the INRMP) is to fence the eastern boundary of the reserve to prevent unauthorized activities, as well as prevent Philippine deer and feral pigs from accessing the reserve area. Some direct impact to existing recreational resources would still be anticipated due to the long-term increased population of Marines and their dependents on Guam. However, managing access to the ERA may minimize potential impacts from the increase in potential users and unauthorized activities (e.g., camping and fires). Operations-phase implementation of this alternative would result in a less than significant direct, long-term impact for the same reasons described above for construction.

Since Alternative A does not have significant impacts to recreational resources, the magnitude of recreational impacts would be less than Alternative D, which has potentially significant impacts.

4.1.8 Terrestrial Biological Resources

4.1.8.1 Affected Environment

The affected environment for terrestrial biological resources associated with Alternative A is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.2: Finegayan, pages 10-34 to 10-39), and is summarized below for reference. This description of the affected environment is supplemented and updated with new information regarding biological surveys within the project areas conducted after the 2010 Final EIS. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for terrestrial biological resources, but it would reduce some potential impacts to terrestrial biological resources as described in the analysis of environmental consequences for Alternative A below. In addition, the biological resources affected environment described in this section includes areas associated with the development of infrastructure common to all alternatives (e.g., off-site utilities).

Vegetation Communities

Vegetation communities associated with Alternative A are the same as described in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.2: Finegayan, pages 10-34 to 10-35). The vegetation types within Finegayan are shown in Figure 4.1.8-1. Vegetation communities in other areas required to support the proposed cantonment/family housing (i.e., utility corridors within AAFB) are shown in Figure 4.1.8-2. The mapped community types in these areas have not changed since the 2010 Final EIS. Utility corridors shown on Figures 4.1.8-2, 2.3-5, and 2.3-12 follow roadways, are in high-use areas on developed land, or are in areas with small amounts of herbaceous-scrub vegetation.

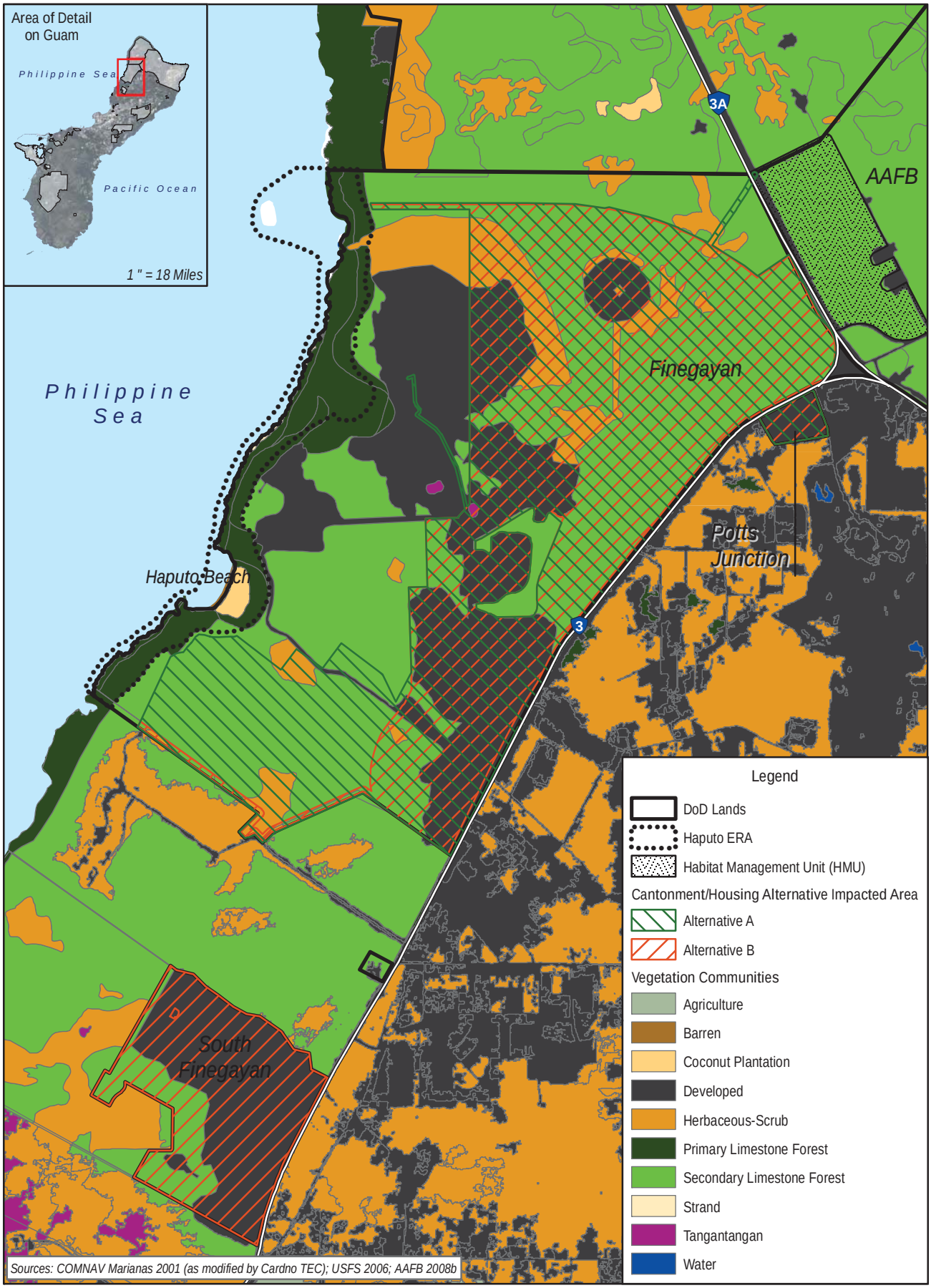


Figure 4.1.8-1
Vegetation Communities - Finegayan and South Finegayan

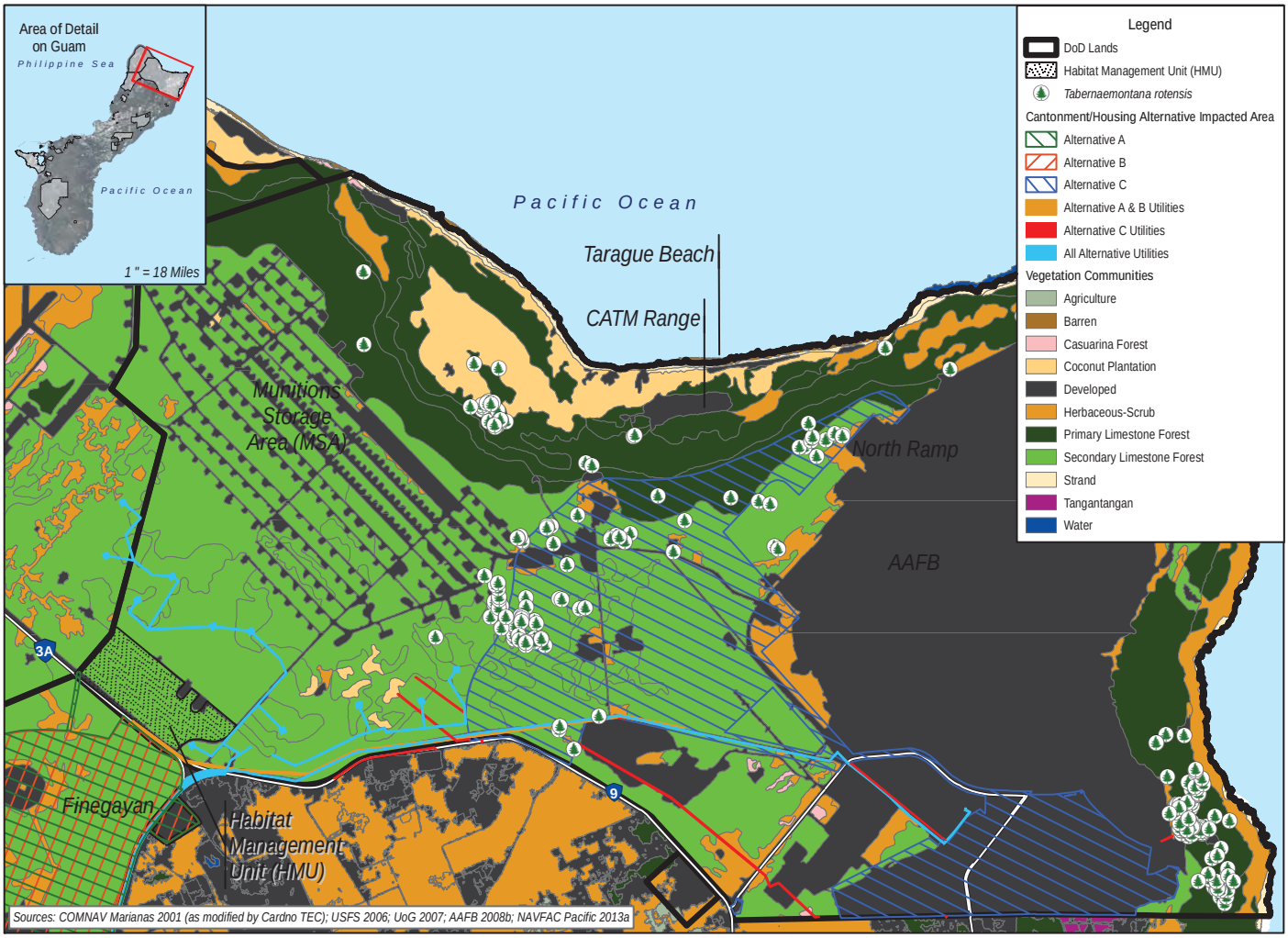


Figure 4.1.8-2
Vegetation Communities and Plant SOGCN Observations - Finegayan and AAFB

Terrestrial Conservation Areas

Overlay Refuge. Currently, 21,690 acres (8,778 ha) is Overlay Refuge on lands administered by the DoD on Guam. The Overlay Refuge encompasses lands identified in the initial recovery plans as essential habitat for the recovery of the Mariana fruit bat, Guam Micronesian kingfisher, Mariana crow, and Guam rail. However, only the Mariana fruit bat still occurs in the wild on Guam. Additional information on Overlay Refuge lands is provided in Section 3.8.1.2 of this SEIS and the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.1.3: Special-Status Species, pages 10-8 to 10-9). All of the undeveloped area of Finegayan is within the established Overlay Refuge (Figure 4.1.8-3).

Haputo ERA. Based on the 1983 EIS for the construction of an ammunition wharf at Adotgan Point in Outer Apra, an MOU between the Navy and GovGuam identified several mitigation measures that would be taken to minimize adverse impacts to the environment, including establishment of an ERA at Haputo Point. The Chief of Naval Operations (CNO) established the Haputo ERA in 1984 (Figure 4.1.8-3). The ERA was established following a watershed approach, which included a terrestrial unit and a marine unit. An ERA is an area dedicated primarily or exclusively to preserving examples of ecosystems and genetic diversity while providing opportunities for scientific research and education. Limited, low-impact recreational opportunities are permitted provided they do not result in adverse changes to the ecological characteristics to the ERA and are consistent with JRM policies. Permitted recreational activities are primarily beach activities including beach combing, swimming, snorkeling, and scuba diving (NAVFAC Marianas 2010).

Wildlife - Native Species

The 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: Andersen AFB, pages 10-22 to 10-24) provides information about native and non-native wildlife species present at Finegayan and AAFB. Additional information from biological resources surveys conducted after the 2010 Final EIS is summarized below.

During detailed surveys of migratory birds within open habitats on AAFB in 2011, 997 individuals of 9 species were observed (NAVFAC Marianas 2013b). Six species were identified in short-grass habitat with Pacific golden plover being the most commonly observed followed by the ruddy turnstone. Other species observed included wood sandpiper, wandering tattler, gray-tailed tattler, sharp-tailed sandpiper, Pacific reef heron, whimbrel, and ruff. Other native bird species observed on AAFB in past studies, as described in the 2010 Final EIS, include yellow bittern, fairy tern, barn swallow, and fork-tailed swift.

The primary non-native species of concern within the project areas are the brown treesnake, Philippine deer, and feral pig. The brown treesnake has had a profound effect on the native animal populations in Guam, and is widely regarded as being responsible for extirpating or limiting many bird species on Guam (Fritts and Rodda 1998). Deer grazing on native tree seedlings adversely affects native tree and forest regeneration, potentially leading to increased erosion. Pigs dig up soil while foraging and wallowing, which also causes erosion and creates openings for non-native invasive plants. There have been no additional data regarding non-native species at Finegayan and AAFB since the 2010 Final EIS.

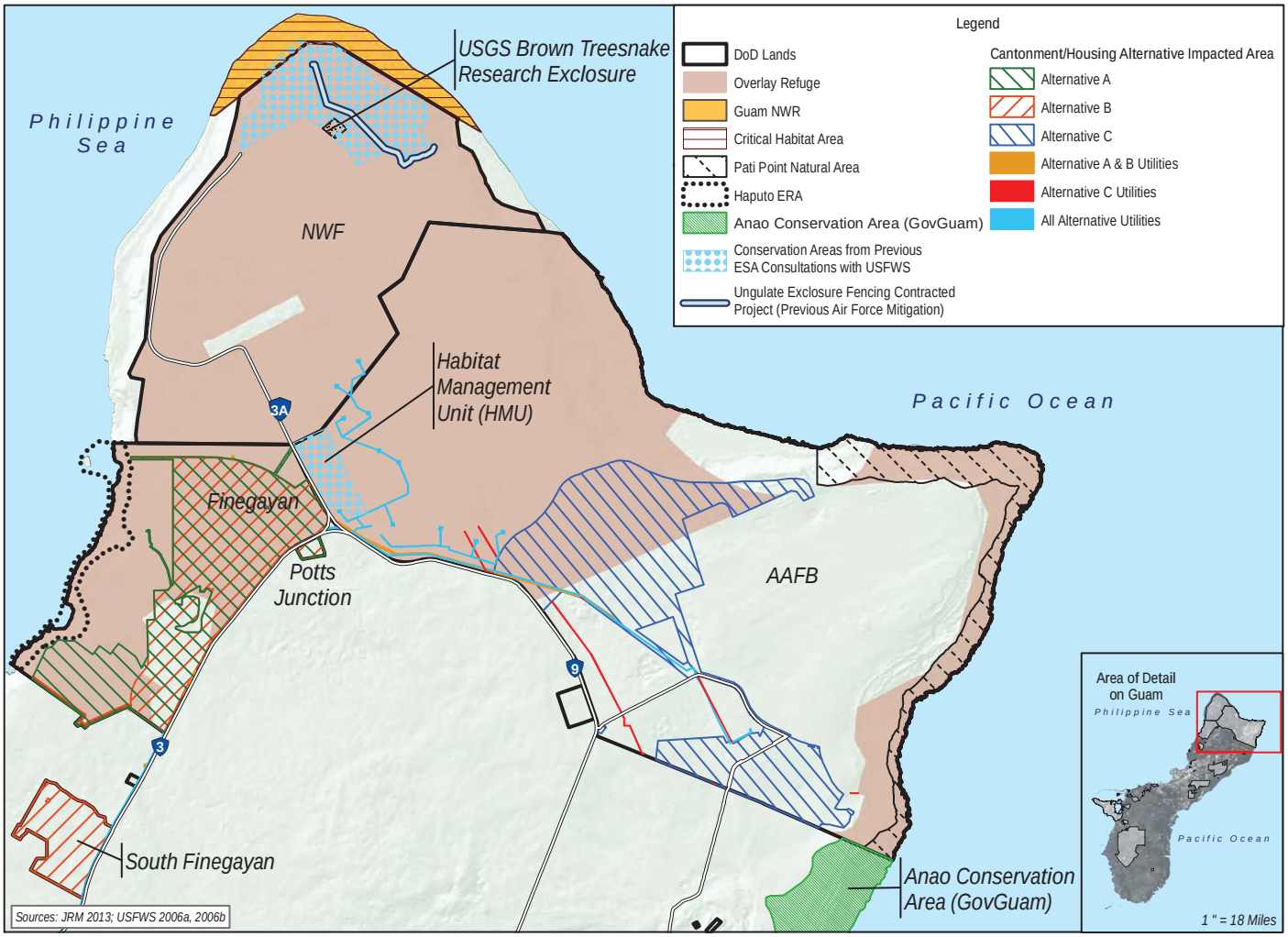


Figure 4.1.8-3
Terrestrial Conservation Areas - Finegayan and AAFB

Special-Status Species: Federal ESA-Listed and Proposed Species

One ESA-listed species (Mariana fruit bat) and one ESA proposed threatened species (*Tabernaemontana rotensis*) occur within Finegayan and the support areas in south-central AAFB (Table 4.1.8-1 and Figures 4.1.8-4 and 4.1.8-5). Although "suitable habitat" for special-status wildlife species is present within the Alternative A project area, the brown treesnake, the primary factor in the extirpation of special-status wildlife species on Guam and one of the largest obstacles to achieving recovery of these species, is still considered abundant and widespread on Guam. Until brown treesnakes are suppressed or removed from at least targeted areas on Guam, the habitat is not in a suitable condition to support the survival of special-status species (e.g., Guam Micronesian kingfisher, Guam rail, Mariana crow) due to current snake abundance on Guam (USFWS 2010a).

Table 4.1.8-1. Distribution of Special-Status Species at Finegayan, South Finegayan, and AAFB Support Areas Associated with the Cantonment/Family Housing Alternatives

Name	*Status**		*Habitat*	*Known to Occur*†*	*Comments†*
	ESA[(d)]	*Guam[(j)]*			
Mammals					
Mariana fruit bat[(a, c, m, t, u, v, bb)]	T	E	Limestone forest, coastal forest, and coconut plantations.	Fin: Yes	Although observed within the adjacent HMU, last observations at Finegayan were in 2008; no known colonial roost sites; recovery habitat present.
				S Fin: No	No known records due to developed nature of parcel; recovery habitat present.
				AAFB: Yes	Few individuals occur throughout AAFB; no known colonial roost sites; recovery habitat present.
Birds					
Mariana swiftlet[(a, m)]	E	E	Limestone cliffs with caves for roosting & nesting; forages over forest and grasslands.	Fin: No S Fin: No AAFB: No	NR; one nest/roost cave at Ritidian Point that was abandoned in late 1970s.
Mariana crow[(w, bb)]	E	E	All forests with a preference for native limestone forest.	Fin: No S Fin: No AAFB: No	Extirpated from Guam – last seen on Finegayan in the 1990s and on AAFB in 2012; recovery habitat present on Finegayan, South Finegayan, and AAFB.
Guam rail[(y, bb)]	E	E	Secondary habitats, some use of savanna and limestone forests.	Fin: No S Fin: No AAFB: No	Extirpated from the wild on Guam by 1985; recovery habitat present on Finegayan, South Finegayan, and AAFB.
Guam Micronesian kingfisher[(x, bb)]	E	E	Forest and scrub with a preference for native limestone forest.	Fin: No S Fin: No AAFB: No	Extirpated from the wild on Guam by 1988; recovery habitat present on Finegayan, South Finegayan, and AAFB.
Micronesian starling[(a, m, aa)]	-	E	All habitats but higher density in forests.	Fin: Yes S Fin: Yes	Infrequent observations near the main gate of Finegayan.
				AAFB: Yes	Present in the AAFB family housing area and occasionally throughout AAFB.
White-throated ground dove[(m, n)]	-	E	Prefers native limestone and ravine forests.	Fin: No S Fin: No	NR
				AAFB: No	Rare observations within MSA and southeastern corner of AAFB.

Table 4.1.8-1. Distribution of Special-Status Species at Finegayan, South Finegayan, and AAFB Support Areas Associated with the Cantonment/Family Housing Alternatives

Name	*Status**		*Habitat*	*Known to Occur*†*	*Comments†*
	ESA[d]	*Guam[j]*			
Reptiles					
Green turtle Hawksbill turtle[a, m, p]	T E	T E	Suitable beaches for basking or nesting.	Fin: No	Haputo Beach: no known nesting (2 false crawls observed in 2008); no nesting observed during 2010-2012 surveys.
				S Fin: No AAFB: No	Only occur on Haputo and Tarague beaches.
Slevin's skink[cc]	PE	E	Mid-elevation closed humid and montane forests.	Fin: No S Fin: No AAFB: No	NR during 2010 and 2012 surveys; has not been recorded on Guam since 1945 and is believed to be extirpated from Guam.
Moth skink[j, k, l, m]	-	E	Forest areas with large tree trunks.	Fin: Yes	Reported in the early 1990s at Haputo Beach area; detected in 2008 and 2011 in northeastern corner.
				S Fin: No	NR during 2010 and 2012 surveys.
				AAFB: Yes	Reported in 2009 at one location in proposed utilities area.
Pacific slender-toed gecko[j, k, l, m]	-	E	Forest edge.	Fin: Yes	Observed in 2009 in northeastern area.
				S Fin: No	NR during 2010 and 2012 surveys.
				AAFB: Yes	Observed in the HMU.
Invertebrates					
Mariana eight-spot butterfly[k, h, m, o, s, cc]	PE	-	Intact limestone forest with host plants.	Fin: No	NR during 2010 and 2012 surveys; host plants, eggs and larvae in Haputo ERA.
				S Fin: No	Individuals and host plants not observed during 2010, 2012, and 2013 surveys.
				AAFB: No	NR during 2010 and 2012 surveys; host plants, eggs and larvae in Tarague Basin.
Mariana wandering butterfly[o, z, cc]	PE	-	Larvae feed on one known host plant species found in native limestone forest habitat.	Fin: No S Fin: No AAFB: No	Has not been seen on Guam since 1979 and considered extirpated; single remaining population occurs on Rota, CNMI; host plants observed within impacted areas of Finegayan, South Finegayan, and AAFB.
Guam tree snail[a, e, i, o, cc]	PE	E	Cool shaded forested areas with high humidity.	Fin: No	Reported in 1989, 2007, and 2013 at Haputo ERA.
				S Fin: No	NR during 2010 and 2013 surveys – suitable habitat not present.
				AAFB: No	NR during 2013 surveys.
Humped tree snail[a, f, i, m, o, cc]	PE	E	Cool shaded forested areas with high humidity.	Fin: No	Reported in 1989, 2007, and 2013 at Haputo ERA.
				S Fin: No	NR during 2010 and 2013 surveys – suitable habitat not present.
				AAFB: No	NR during 2013 surveys.
Fragile tree snail[a, g, i, m, o, cc]	PE	E	Cool shaded forested areas with high humidity.	Fin: No	Reported in 1989, 2007, and 2013 at Haputo ERA.
				S Fin: No	NR during 2010 and 2013 surveys – suitable habitat not present.
				AAFB: No	NR during 2013 surveys.
Plants					
Serianthes tree[a, c, m, r, s, bb]	E	E	Limestone and ravine forests.	Fin: No	NR during 2010 and 2012 surveys; recovery habitat present.
				S Fin: No	NR during 2010 and 2012 surveys – recovery habitat not present.
				AAFB: No	NR during 2010 and 2012 surveys; recovery habitat present; individual trees only occur at AAFB at NWF and Tarague Basin.

Table 4.1.8-1. Distribution of Special-Status Species at Finegayan, South Finegayan, and AAFB Support Areas Associated with the Cantonment/Family Housing Alternatives

Name	Status*		Habitat	Known to Occur*†	Comments†
	ESA[(d)]	Guam[(j)]			
Heritiera tree[(a, b, m, s, cc)]	PE	E	Limestone cliffs and plateaus.	Fin: No	NR during 2010 and 2012 surveys; no known individuals within project areas.
				S Fin: No	NR during 2010 and 2012 surveys – suitable habitat not present.
				AAFB: No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Tabernaemontana rotensis[(l, m, q, s, cc)]	PT	SOGCN	Limestone forest.	Fin: No S Fin: No	NR during 2010 and 2012 surveys; no known individuals within project areas.
				AAFB: Yes	Large numbers observed in 2007 in central and southeastern areas.
Cycas micronesica[(k, l, m, s, cc)]	PT	SOGCN	Limestone forest, ravine forest, and savanna summits.	Fin: No	NR during 2010 and 2012 surveys; no known individuals within project areas.
				S Fin: No	NR during 2010 and 2012 surveys – suitable habitat not present.
				AAFB: No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Bulbophyllum guamense[(cc)]	PE	-	Lowland/limestone forests.	Fin: Yes S Fin: No AAFB: No	No known individuals within project areas.
Dendrobium guamense[(cc)]	PE	-	Lowland/limestone forests.	Fin: Yes S Fin: No AAFB: No	One occurrence within northeastern area of Finegayan.
Eugenia bryanii[(cc, dd)]	PE	-	Windy exposed coastal clifflines in lowland/limestone forests.	Fin: No S Fin: No AAFB: Yes	Currently known from 6 occurrences on Guam, none within the proposed Finegayan project areas. One individual was observed in July 2014 to the west of the southern end of the AAFB flightline.
Maesa walkeri[(cc)]	PE	-	Lowland/limestone forests.	Fin: No S Fin: No AAFB: No	No known individuals within project areas.
Nervilia jacksoniae[(cc)]	PE	-			No known individuals within project areas.
Psychotria malaspinae[(cc)]	PE	-			No known individuals within project areas.
Solanum guamense[(cc)]	PE	-			No known individuals within project areas.
Tinospora homosepala[(cc)]	PE	-			No known individuals within project areas.
Tuberolabium guamense[(cc)]	PE	-	Lowland/limestone forests.	Fin: Yes S Fin: No AAFB: No	One occurrence within northeastern area of Finegayan.

Legend: - = not listed, E = endangered, NR = not reported within impacted areas, PE = proposed endangered, PT = proposed threatened, T = threatened.
†Occurrence within Finegayan (Fin), South Finegayan (S Fin) or AAFB cantonment/family housing or utility impacted areas.

Sources: [(a)]Wiles *et al.* 1995; [(b)]GDAWR 2006; [(c)]USFWS 2010a; [(d)]USFWS 2011; [(e)]USFWS 2012a; [(f)]USFWS 2012b; [(g)]USFWS 2012c; [(h)]USFWS 2012d; [(i)]Smith *et al.* 2008; [(j)]GovGuam 2009; [(k)]NAVFAC Pacific 2010, [(l)]NAVFAC Pacific 2010; [(m)]JRM 2013; [(n)]NAVFAC Marianas 2013b; [(o)]UoG 2014; [(p)]Grimm and Farley 2008; [(q)]UoG 2007; [(r)]USFWS 1994; [(s)]NAVFAC Pacific 2013a, 2013b; [(t)]AAFB 2008b; [(u)]JRM *et al.* 2012a; [(v)]JRM *et al.* 2012b; [(w)]USFWS 2005; [(x)]USFWS 2008b; [(y)]USFWS 2009b, BirdLife International 2013; [(z)]USFWS 2013; [(aa)]Personal communication from J. Farley, NAVFAC Marianas, to R. Spaulding, Cardno TEC, regarding Micronesian starling observations at NCTS Finegayan during December 2010 Christmas Bird Count, 26 February 2014; [(bb)]USFWS 2010b; [(cc)]USFWS 2014a, 2014b; [(dd)]Personal communication from J. Farley, NAVFAC Marianas, to R. Spaulding, Cardno, regarding *Eugenia bryanii* observation at AAFB, 29 October 2014.

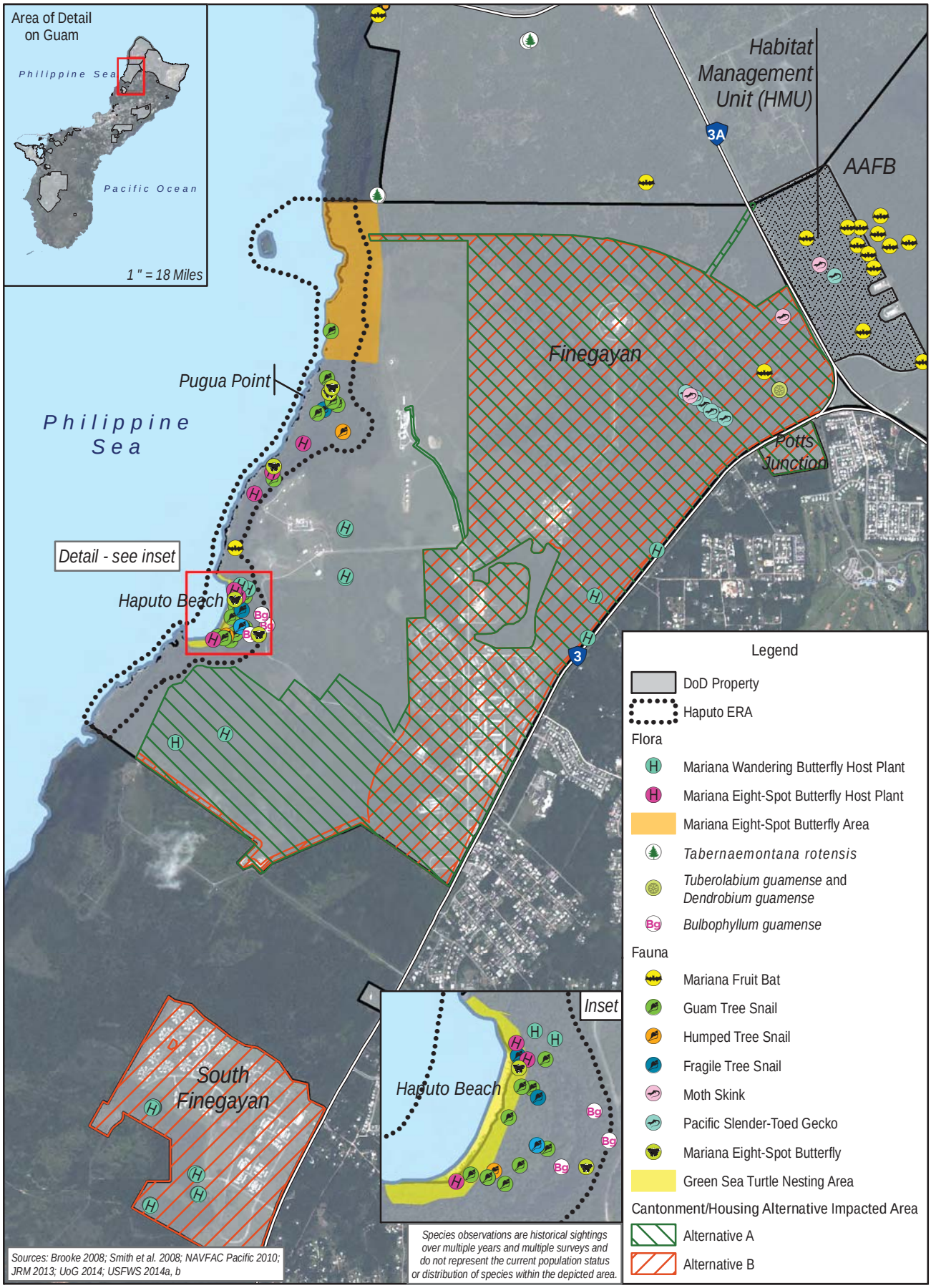


Figure 4.1.8-4
Special-Status Species Observations - Finegayan and South Finegayan

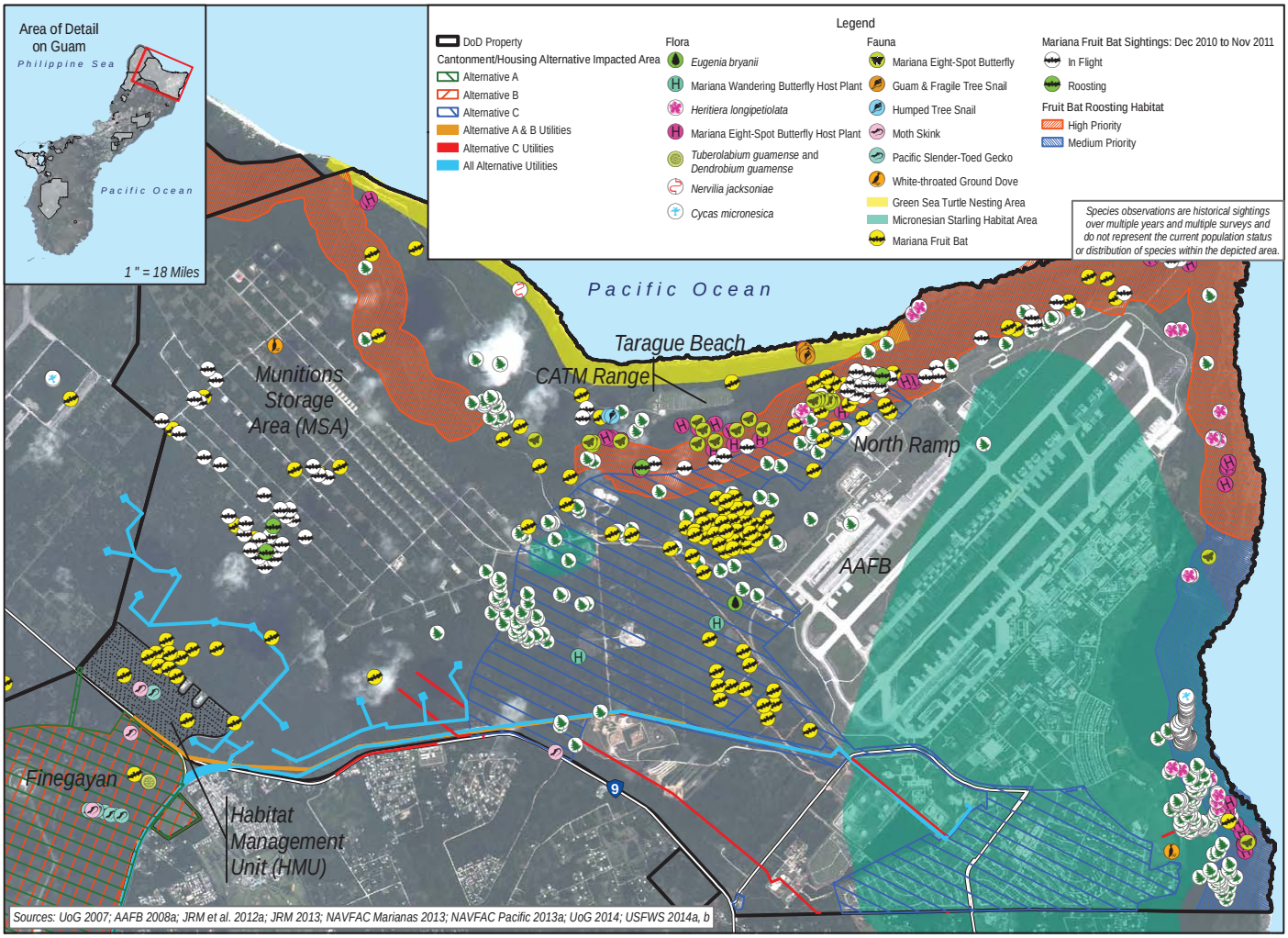


Figure 4.1.8-5
Special-Status Species Observations - Finegayan and AAFB

A brief summary of each species is provided below, including new information about each species within the project area since the completion of the 2010 Final EIS. Further information is provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: Andersen AFB, pages 10-24 to 10-33 and Section 10.1.3.2: pages 36-39).

MARIANA FRUIT BAT. Mariana fruit bat population estimates on Guam in 2006 indicated fewer than 100 individuals (Janeke 2006). In 2009, the number of fruit bats on Guam was estimated to be less than 50 individuals (USFWS 2009a). Of the estimated 6,610-6,930 total Mariana fruit bat individuals, fewer than 20 occur on Guam, with the remaining occurring within the CNMI (USFWS 2010a). The declining number of bats on Guam are threatened by habitat loss and degradation of native forests, hunting, and brown treesnake predation on non-volant juveniles (USFWS 2009a).

Extensive surveys conducted throughout AAFB between December 2010 and December 2011 resulted in a conservative estimate of approximately 25 fruit bats (JRM *et al.* 2012a). Only 50 detections of individual bats were recorded during 84 station count surveys from March through September 2012, and no active fruit bat aggregation or colony site was discovered (JRM *et al.* 2012b). It is likely that a small number of solitary-roosting fruit bats also occur on Navy lands (e.g., NAVMAG). Solitary individuals can move to and from roosting and foraging areas during the year. Due to the protected environment of AAFB, the majority of fruit bats remaining on Guam reside on AAFB (USFWS 2010a; Dr. A. Brooke, Natural Resources Program Manager, NAVFAC Marianas, personal communication, 2013).

Recent observations were of single flying and (in a few cases) roosting fruit bats and were most commonly observed in three general regions on AAFB as shown in Figure 4.1.8-5: the cliffline extending from above the Combat Arms Training and Maintenance (CATM) Range east to Pati Point; in or near the Munitions Storage Area (MSA); and in the vicinity of the Habitat Management Unit (HMU) (JRM *et al.* 2012a). High and medium priority fruit bat roosting habitat as defined in the AAFB *Mariana Fruit Bat Management Plan* are depicted in Figure 4.1.8-5. These areas were identified based on historical colony roost locations and current habitat conditions on AAFB (AAFB 2008b).

The Haputo ERA contains some of the best remaining fruit bat habitat (primary and secondary limestone forest) on DON-managed lands (NAVFAC Marianas 2010; JRM 2013). As fruit bats are known to travel 6-7.5 miles (10-12 km) to reach forage areas (USFWS 1990), it is expected that fruit bats from AAFB may occasionally use Finegayan, primarily forested areas adjacent to the Haputo ERA, for foraging, and possibly roosting. In 2008, during 10 observation days, one sighting was reported in the Haputo ERA and one in the northeastern portion of Finegayan (Figure 4.1.8-4) (Brooke 2008). There are no known colonial roost areas at Finegayan.

Fruit bat recovery habitat was described by the USFWS in the BO for the Guam and CNMI Military Relocation (USFWS 2010a) and includes the following vegetation communities (based on vegetation mapping by the USFS [2006]) for foraging, roosting, and breeding: primary and secondary limestone forest, coconut plantation, ravine forest, and groves of ironwood. Fruit bat recovery habitat is found within proposed project impacted areas on Finegayan and in support areas on AAFB and adjacent lands (see Figure 3.8.3-1).

MARIANA SWIFTLET. Although Finegayan and AAFB contain potentially suitable swiftlet foraging habitat, the only known occupied nest/roost caves on Guam are located on the NAVMAG more than 20 miles (32 km) south of Finegayan and AAFB. A previously used Mariana swiftlet nest/roost cave is known from Ritidian Point approximately 3 miles (4.8 km) north of the proposed Finegayan and AAFB support areas; this cave was abandoned by the late 1970s (USFWS 1991). Given that swiftlets forage within 1-3 miles (1.5-5 km) of their nest/roost caves (Jenkins 1983), it is highly unlikely that individuals

from the only known population on Guam 20 miles (32 km) away would occur within Finegayan or AAFB. Therefore, as the Mariana swiftlet is not found within the impacted areas of Alternative A, this species is not addressed further.

MARIANA CROW. The Mariana crow was last observed on Finegayan in the 1990s (USFWS 2005). Since 2009, the population on Guam consisted only of two males on AAFB, occurring primarily within the MSA (USFWS 2009c). However, as of 2012, the Mariana crow is considered extirpated in the wild on Guam (Personal communication via letter from USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, HI regarding the DON NOI for Proposed Placement of LFTRC on Guam NWR; December 7, 2012). The closest population of crows is on the island of Rota, approximately 56 miles (90 km) north of Guam. Crows in northern Guam used primary limestone forest for nesting, with nests exclusively in native trees. They have been observed foraging in both primary and secondary limestone forests and tangantangan (USFWS 2005). Crow recovery habitat is found within proposed project impacted areas on Finegayan and in support areas on AAFB and adjacent lands (see Figure 3.8.3-1).

GUAM RAIL. The Guam rail has been extirpated in the wild on Guam since 1985 and exists primarily in captivity on Guam and in mainland zoos. Experimental populations of Guam rails were introduced onto Rota, CNMI in 1989 and onto Cocos Island, off the southern coast of Guam, in 2011 (USFWS 2009b; BirdLife International 2013). The Guam rail prefers edge habitats, especially grassy or secondary vegetation areas which provide good cover; mature forest is deemed only marginal for the Guam rail (USFWS 2009b). Rail recovery habitat within the proposed impacted areas at Finegayan and the AAFB support areas includes secondary limestone forest, herbaceous scrub, coconut forest, and tangantangan (see Figure 3.8.3-2).

GUAM MICRONESIAN KINGFISHER. The Guam Micronesian kingfisher was extirpated in the wild by 1988 and is now found only in captivity on Guam and at mainland zoos (USFWS 2008). Kingfishers utilized a wide variety of habitats including primary and secondary limestone forest, strand forest, coconut forest, edge habitats, and forest openings, but mature forests with tree cavities suitable for nesting may be an important requirement for kingfisher reproduction (USFWS 2008b). Kingfisher recovery habitat within the proposed impacted areas at Finegayan and the AAFB support areas includes primary and secondary limestone forest, coconut forest, and tangantangan (see Figure 3.8.3-1).

SEA TURTLES. Two suspected nest attempts and two false crawls were documented in April 2008 at Haputo Beach (presumably of green sea turtles, although this is not confirmed) (Grimm and Farley 2008). No sea turtle activity was observed at Haputo beach during 51 beach surveys from October 2010 through August 2012 (NAVFAC Marianas 2011; Brindock 2012). The hawksbill sea turtle has been observed offshore of Finegayan but there have been no known nesting attempts by this species at Haputo Beach (JRM 2013).

SLEVIN'S SKINK. Originally found on Guam, Cocos Island, Rota, Tinian, Guguan, Alamagan, Asuncion, and Maug, it is now limited to Cocos Island, Sarigan, Guguan, Alamagan, Pagan, and Asuncion. Slevin's skink has not been recorded on Guam since 1945 and is believed to be extirpated from Guam; it is now known to occur only on Cocos Island (an atoll south of Guam) (USFWS 2014a). There are no records of the species within the impacted areas of Finegayan or AAFB support areas (USFWS 2014b). Therefore, as Slevin's skink is not found within the impacted areas of Alternative A, this species is not addressed further.

TREE SNAILS. Tree snails prefer cool, dense, shaded native forest communities, with high humidity and reduced air movement to conserve moisture (USFWS 2012a, b, c). These conditions are found predominantly in primary limestone forests. Three ESA proposed endangered and Guam-listed

endangered native tree snails (Guam tree snail, humped tree snail, and fragile tree snail) were reported in 1989 within the Haputo ERA (Hopper and Smith 1992). A 2008 survey found two colonies within the Haputo ERA, one known historically at Haputo Beach and another further north at Pugua Point, but still within Haputo ERA. The Pugua Point site contained fragile and Guam tree snails, while the Haputo Beach site contained humped and Guam tree snails (see Figure 4.1.8-4) (Smith *et al.* 2008). Surveys conducted in 2013 in support of this SEIS found approximately 245 individual Guam tree snails, 112 humped tree snails, and 3 fragile tree snails within the Haputo ERA (see Figure 4.1.8-4) (UoG 2014). There are no records of tree snails within the Finegayan impacted areas (USFWS 2014b). No tree snails have been reported from the support areas on AAFB and adjacent lands; however, there is a documented presence of all three species in Tarague basin to the north of the impacted areas (see Figure 4.1.8-5).

MARIANA EIGHT-SPOT BUTTERFLY. Two populations of the ESA proposed endangered Mariana eight-spot butterfly have been reported near Tweed's Cave in the Haputo ERA (USFWS 2012d, 2014b). Surveys conducted in 2013 in support of this SEIS observed eight-spot butterflies within the Haputo ERA at Pugua Point and both host plants (*Elatostema calcareum* and *Procris pedunculata*) at Haputo Beach (see Figure 4.1.8-4) (UoG 2014). Although there are no records of the two known host plant species within the Finegayan impacted areas, 2010 surveys recorded a small patch of the host plant *Procris pedunculata* in the northern portion of Finegayan, near the border with the Haputo ERA and the known eight-spot butterfly area (see Figure 4.1.8-4) (NAVFAC Pacific 2010). Mariana eight-spot butterflies and host plants have been reported from the support areas on AAFB and adjacent lands (see Figure 4.1.8-5) (JRM 2013; NAVFAC Marianas 2013b; NAVFAC Pacific 2013a; UoG 2014; USFWS 2014b).

MARIANA WANDERING BUTTERFLY. The ESA proposed endangered Mariana wandering butterfly has not been seen on Guam since 1979 and is considered extirpated; a single remaining population occurs on Rota, CNMI (USFWS 2013). The only species known to be a Mariana wandering butterfly host plant (*Maytenus thompsonii*) is a common shrub of limestone forests on Guam and has been observed within the impacted areas of Finegayan and the support areas on AAFB (see Figures 4.1.8-4 and 4.1.8-5) (Moore and McMakin 2001; UoG 2014; USFWS 2014b).

SERIANTHES TREE. There are no records of the *Serianthes* tree within the Finegayan impacted areas or support areas on AAFB and adjacent lands (USFWS 2014b). The only known locations of individual trees are a single tree at NWF and two saplings at Tarague Basin (JRM 2013). However, recovery habitat does occur within the impacted areas of Finegayan and the support areas on AAFB (see Figure 3.8.3-2).

HERITIERA LONGIPETIOLATA. This endemic tree is found on AAFB in crevices of rough limestone in primary limestone forest. A 2007 study documented the species as occurring at numerous locations on AAFB, primarily in the central portion of the base, and near the limestone cliffs in the northeast and southeast corners (UoG 2007) (see Figure 4.1.8-5). There are no records of the species within the impacted areas of Finegayan or AAFB support areas (USFWS 2014b). Therefore, as ***H. longipetiolata*** is not found within the impacted areas of Alternative A, this species is not addressed further.

TABERNAEMONTANA ROTENSIS. There are no records of ***T. rotensis*** within the Finegayan impacted areas. The distribution of this tree species on AAFB was evaluated in 2007 and over 21,000 ***T. rotensis*** individuals were found throughout AAFB at 265 mapped locations, primarily in the central portion of the base and near the limestone cliffs in the northeast (see Figure 4.1.8-2) (UoG 2007). A few individuals have been recorded within the proposed utility support areas in south-central AAFB (see Figure 4.1.8-2).

CYCAS MICRONESICA. The cycad is found in limestone forests throughout Guam, including AAFB, and is proposed as an endangered species under the ESA because of the Asian cycad scale insect that is devastating the species (USFWS 2014a). This species has not been observed within the Finegayan and

AAFB impacted areas associated with the cantonment/family housing alternatives during past surveys (AAFB 2008a; NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014b). Therefore, as *C. micronesica* is not found within the impacted areas of Alternative A, this species is not addressed further.

BULBOPHYLLUM GUAMENSE. An epiphyte in the orchid family, this species occurs in mat-like formations on tree branches of coastal lowland/limestone forests. Currently there are 8 known occurrences on Guam, totaling fewer than 250 individuals (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Finegayan or AAFB support areas (USFWS 2014b). Therefore, as *B. guamense* is not found within the impacted areas of Alternative A, this species is not addressed further.

DENDROBIUM GUAMENSE. An epiphyte in the orchid family, this species occurs on tree branches of coastal lowland/limestone forests. Currently, there are 4 known occurrences on Guam with fewer than 250 individuals (USFWS 2014a, 2014b). There is one occurrence within northeastern area of Finegayan (see Figure 4.1.8-4).

EUGENIA BRYANII. A perennial shrub in the myrtle family, the species is known only from the island of Guam. Historically, *E. bryanii* is known from windy exposed coastal clifflines and along the Pigua River, in lowland/limestone forests. Currently, *E. bryanii* is known from 6 occurrences totaling fewer than 420 individuals (USFWS 2014a, 2014b). Only one occurrence is within the vicinity of the proposed project areas – one individual plant was observed in July 2014 to the west of the southern end of the AAFB flightline (Figure 4.1.8-5) (Personal communication from J. Farley, NAVFAC Marianas, to R. Spaulding, Cardno, regarding *Eugenia bryanii* observation at AAFB, 29 October 2014). There are no records of the species within the impacted areas of Finegayan or AAFB support areas (USFWS 2014b). Therefore, as *E. bryanii* is not found within the impacted areas of Alternative A, this species is not addressed further.

MAESA WALKERI. A shrub or small tree in the primrose family typically found in limestone forests, this species is known from only two individuals on Guam – one individual on Mt. Lamlam and one individual on Mt. Almagosa (USFWS 2014a). There are no records of the species within the impacted areas of Finegayan or AAFB support areas (USFWS 2014b). Therefore, as *M. walkeri* is not found within the impacted areas of Alternative A, this species is not addressed further.

NERVILIA JACKSONIAE. A small herb in the orchid family, this species is found in lowland/limestone forests. On Guam, *N. jacksoniae* is known from 2 occurrences totaling fewer than 200 individuals: 1 occurrence near the UoG campus and 1 occurrence to the northwest of Tarague Beach (see Figure 4.1.8-5) (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Finegayan or AAFB support areas (USFWS 2014b). Therefore, as *N. jacksoniae* is not found within the impacted areas of Alternative A, this species is not addressed further.

PSYCHOTRIA MALASPINAE. A shrub or small tree in the coffee family, this species is found in lowland/limestone forests. Currently, *P. malaspinae* is known from five occurrences: one individual at Ritidian Point within the Guam NWR, one individual at Pågat Point, one individual at the base of Mt. Almagosa, and two individuals at NWF (USFWS 2014a, 2014b). None of these individuals have been observed within the last 5 years. A specimen collected from the Ritidian NWR in August 2013 is currently pending identification (USFWS 2014a). There are no records of the species within the impacted areas of Finegayan or AAFB support areas (USFWS 2014b). Therefore, as *P. malaspinae* is not found within the impacted areas of Alternative A, this species is not addressed further.

SOLANUM GUAMENSE. A small shrub in the nightshade family that occurs within limestone forests. Currently, *S. guamense* is known from a single occurrence of one individual on Guam (USFWS 2014a). There are no records of the species within the impacted areas of Finegayan or AAFB support areas

(USFWS 2014b). Therefore, as *S. guamense* is not found within the impacted areas of Alternative A, this species is not addressed further.

TINOSPORA HOMOSEPALA. A vine in the moonseed family found in limestone forests. Currently, *T. homosepala* is known from 3 occurrences totaling approximately 300 individuals: 1 occurrence on the western side of Asan Ridge, 1 occurrence near the War in the Pacific Historical Park, and 1 occurrence on the cliff face at Hagåtña (USFWS 2014a). There are no records of the species within the impacted areas of Finegayan or AAFB support areas (USFWS 2014b). Therefore, as *T. homosepala* is not found within the impacted areas of Alternative A, this species is not addressed further.

TUBEROLABIUM GUAMENSE. An epiphyte in the orchid family found in limestone forests. Currently, *T. guamense* is known from three occurrences on Guam: two occurrences within the NAVMAG and one in the northeastern area of Finegayan (see Figure 4.1.8-4) (NAVFAC Pacific 2010; USFWS 2014a, 2014b).

Special-Status Species: Guam-Listed Species and SOGCN

Three Guam-listed endangered species occur within Finegayan and AAFB support areas; those species that are Guam-listed or Guam SOCGN that are also federally listed or proposed for listing under the ESA were discussed previously (see Table 4.1.8-1).

MICRONESIAN STARLING. The Micronesian starling is observed infrequently within the main gate area of Finegayan with the last recorded observation in December 2010 (Wiles *et al.* 1995; JRM 2013; Personal communication from J. Farley, NAVFAC Marianas, to R. Spaulding, Cardno TEC, regarding Micronesian starling observations at Naval Computer and Telecommunications Station Finegayan during December 2010 Christmas Bird Count, 26 February 2014). The starling is present in the family housing area at AAFB (JRM 2013; J. Savidge, Colorado State University, personal communication to G. Metzler, Cardno TEC, May 23, 2013) and has also been observed occasionally throughout AAFB (NAVFAC Pacific 2010; JRM *et al.* 2012d; JRM 2013) (see Figure 4.1.8-5). On Guam, it is also present on Cocos Island, parts of Hagåtña, and the southeastern beach strand areas (JRM 2013).

WHITE-THROATED GROUND DOVE. Although the white-throated ground dove is reported as extirpated from Guam due to the brown treesnake (GDAWR 2006), it is seen on very rare occasions on AAFB, primarily within the MSA and the southeastern corner of the base (see Figure 4.1.8-5) (JRM *et al.* 2012a, 2012b; NAVFAC Marianas 2013b; UoG 2014). Observed individuals are thought to be transients from Rota (GDAWR 2006; NAVFAC Marianas 2013b) and a resident or breeding population does not occur on Guam.

MOTH SKINK AND PACIFIC SLENDER-TOED GECKO. The moth skink and Pacific slender-toed gecko have been observed in northeastern Finegayan and the Haputo ERA (see Figure 4.1.8-4) (NAVFAC Pacific 2010). Moth skinks were observed by USGS biologists within the northwest portion of Finegayan across Route 3A from the AAFB HMU (R. Reed, USGS Brown Treesnake Project, personal communication, April 24, 2013). The moth skink was also documented in the early 1990s as occurring on the Haputo ERA (Wiles *et al.* 1995). From May through October 2010, 251 individual sightings of the slender-toed gecko within the AAFB HMU were documented from 17 separate observation dates, and the species has also been observed frequently since then (B. Lardner, USGS Brown Treesnake Project, personal communication, April 25, 2013).

4.1.8.2 Environmental Consequences

Construction

Vegetation. The vegetation communities that would be impacted during proposed facility and infrastructure construction activities under Alternative A are shown within the impact footprint in Figure 4.1.8-1 for the cantonment/family housing area and in Figure 4.1.8-2 for the support areas. A minimal amount (1.9 acres [0.8 ha]) of primary limestone forest and approximately 1,005 acres (407 ha) of secondary limestone forest would be removed during proposed construction activities of the Finegayan cantonment/family housing under Alternative A. Most of the secondary limestone forest that would be impacted (935 acres [378 ha]) is associated with the cantonment/family housing component. Approximately 152 acres (61 ha) of other vegetation communities, primarily herbaceous scrub, and 535 acres (216 ha) of developed areas would also be impacted (Table 4.1.8-2).

Table 4.1.8-2. Direct Impacts to Vegetation Communities with Implementation of Cantonment/Family Housing Alternative A

Project Component	*Vegetation Community (acres [ha])*					
	PLF	***SLF***	***HS***	***TT***	***Dev***	***Total***
Finegayan cantonment/family housing	0.4 (0.2)	934.9 (378.3)	137.0 (55.4)	1.0 (0.4)	421.9 (170.7)	**1,495.2 (605.3)**
Utility corridor specific to Alternative A	0	13.0 (5.3)	0.1 (<0.1)	0	17.0 (6.9)	**30.1 (12.2)**
Utility corridors and water well areas common to Alternatives A-E	1.5 (0.6)	57.3 (23.2)	9.5 (3.8)	4.5 (1.8)	78.7 (31.8)	**151.5 (61.3)**
High School/Middle School Expansions	0	0	0	0.3 (0.1)	17.2 (7.0)	**17.5 (7.1)**
Total	**1.9 (0.8)**	**1,005.2 (406.8)**	**146.6 (59.3)**	**5.8 (2.3)**	**534.80 (216.4)**	**1,694.3 (685.7)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; TT = tangantangan; Dev = developed.

Native limestone forest, both primary and secondary, has been significantly reduced on Guam due to past and ongoing actions including extensive disturbance during and after WWII, widespread planting of non-native species, and impacts from non-native ungulates, development, fire, and deforestation. As stated in Section 3.8.1.1, limestone forests on Guam are important since they retain the functional ecological components of native forest that provide habitat for the majority of Guam's native species, including ESA-listed, ESA-proposed, and Guam-listed species, and Guam SOGCN, as well as maintaining water quality and reducing fire risk. Non-native forest communities (e.g., tangantangan, *Vitex*) significantly alter the forest structure, composition, and resilience to other disturbance processes and do not provide the conditions suitable for native flora and fauna species to persist (Morton *et al.* 2000; GDAWR 2006; Guam Department of Agriculture 2010; JRM 2013).

Of the 18,538 acres (7,502 ha) of primary and secondary limestone forest found on Guam, approximately 13,110 acres (5,305 ha) (or 71%) are found primarily within AAFB, Finegayan, and the NAVMAG (USFS 2006). The most intact native limestone forest in the vicinity of the proposed impacted areas is within the Haputo ERA, which would not be impacted from proposed construction activities. Under Alternative A, approximately 1,007 acres (408 ha) of limestone forest would be removed, primarily within Finegayan (see Table 4.1.8-2). Therefore, given the importance of limestone forest habitat for native species and the continuing loss of limestone forest across Guam, the conversion of 1,007 acres (408 ha) of limestone forest on Finegayan to developed area would be a significant but mitigable impact to the regional vegetation community and its function.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on vegetation communities with implementation of Alternative A. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

Regional Biosecurity Plan (RBP). To address pathways and encourage a more holistic approach to managing invasive species, the DON funded the development of a RBP for Micronesia and Hawaii (formerly referred to as the Micronesia Biosecurity Plan) (UoG and Secretariat of the Pacific Community 2014). Individual activities for various species will continue, but the DON and others agree it is more efficient to manage pathways and prescribe corrective measures for a suite of species which will be monitored at discrete control points over time. The RBP provides stakeholders in Micronesia and Hawaii with a platform for coordination and integration of inter-agency invasive species management efforts such as control, interdiction, eradication, and research.

1. Phase I Risk Assessments: The DON contracted with the USDA Wildlife Services, USDA Animal and Plant Health Inspection Service (APHIS), Plant and Protection and Quarantine, USDA APHIS Veterinary Services (terrestrial); USGS Biological Resources Discipline (freshwater); and Smithsonian Environmental Research Center (marine) for the development of the risk assessments for the RBP. In addition, the National Invasive Species Council was contracted to coordinate the preparation of the risk assessments for the RBP and prepare an executive summary. Phase I was completed in July of 2013.
2. Phase II Peer Review and Strategic Implementation Plan: In September of 2011, the DON entered into a cooperative agreement with the UoG to develop Phase II of the RBP. The UoG was tasked with reviewing all three risk assessments and providing an assessment as to whether the three risk assessments were comprehensive within their respective environment and sufficiently addressed risks posed to Micronesia and Hawaii. The UoG and its resource expert collaborators evaluated each risk assessment to ensure they sufficiently:

    a. evaluated the biosecurity risks particular to each environment;
    b. addressed organisms to be of greatest risk to Micronesia and Hawaii (as it relates to Micronesia);
    c. identified the necessary elements of an effective biosecurity program;
    d. identified management responses that are the most appropriate and have been described and prioritized in sufficient detail to allow for ease of implementation; and
    e. incorporated the input of the relevant regional entities with responsibilities for biosecurity.

The review of the risk assessments was completed in January of 2013.

The UoG was also tasked with developing a strategic implementation plan. The strategic implementation plan component is to:

a. identify and analyze challenges to regional implementation of the RBP and provide multiple implementation alternatives, where appropriate;
b. identify infrastructure, funding, process, political, legislative, policy and capacity gaps within the various region's agencies and jurisdictions relevant to potential invasive species pathways;
c. identify policy and regulatory changes needed to achieve 100% prevention, control and treatment for the identified highest risk pathways, ports of origin, and species for the region;
d. evaluate the technical and institutional capacity (staff, training, etc.);

e. assess infrastructure needs;
f. coordinate with related initiatives; seek out successful models, assistance and collaboration from organizations involved in invasive species management; analyze biosecurity program implementation elsewhere and assess applicability to Micronesian region;
g. target outreach and awareness;
h. identify potential long-term funding mechanisms;
i. identify methods for measuring success/effectiveness, as well as the labor/equipment costs, in U.S. dollars, required to maintain those methodologies;
j. address improvement of biosecurity protection actions;
k. address biological threats associated with enhanced military activities, tourism, trade, business and economic growth;
l. recommend solutions to challenges;
m. recommend strategies (and associated budgetary needs to implement each strategy) to achieve 100% prevention, control and treatment for the identified highest risk pathways, ports of origin, and invasive species for the region; and
n. provide a template to realistically implement the biosecurity strategies identified in the RBP in the United States and within international frameworks.

In May of 2014, the UoG hosted a regional workshop in order for the jurisdictions and development partners to have a final joint working session in which to review and conclude the updating of the implementation component before finalizing the RBP. The final RBP was completed in 2014.

Several of the recommendations in the RBP are incorporated into the Proposed Action as BMPs and are described below.

- *Hazard Analysis and Critical Control Point (HACCP) Plan*. HACCP planning is a pathway management tool that provides a comprehensive method to identify risks and focus procedures to prevent spread of undesirable species through pathways. The pathways used by invasive species to move into new locations are not always obvious. Many problematic species, diseases, and parasites have been transferred to new locations as undetected (and unplanned) hitchhikers. Understanding pathways and developing plans to reduce non-target species and prevent biological contamination is necessary to avoid unintended spread of species. These non-target species could occur on construction equipment or be included in shipments of materials and supplies from locations outside of Guam.

  The DON has required all construction contractors to develop and implement HACCP plans for their construction activities. The construction contractors are to identify and implement control measures to prevent the inadvertent movement of non-native, invasive species to Guam and to and from the project site to other locations on Guam. The contractor is required to establish appropriate facilities that comply with all environmental laws and regulations, provide training for proper vehicle hygiene, and promptly take corrective and preventative actions for non-compliance. This includes vehicle washdown and inspection for soil and other materials and appropriate control measures are implemented to prevent the inadvertent movement of non-native invasive species from the project site to other locations.

  Construction contractors are required to provide documentation that supports prevention, worker awareness training, and control of non-native invasive and pest species in the project area and efforts to prevent the movement of non-native invasive species to areas outside the project area, whether in a purposeful or inadvertent manner. The contractor is responsible for ensuring that their employees receive applicable environmental and occupational health and safety training, and

are kept up to date on required regulatory-specific training for the type of work to be conducted onsite. This may include, but is not limited to HACCP planning, species-specific information (e.g., coconut rhinoceros beetle), regulated pest list, threatened and endangered species information, and proper washdown and inspection techniques for equipment.

- To document the effectiveness of the HACCP implementation at construction sites, the DON has developed and implemented a long-term monitoring program for terrestrial vegetation on Guam. For any clearing of vegetation that is adjacent to or contiguous with native habitat, the perimeter and 98 feet (30 m) into the habitat would be surveyed to identify vegetation community species composition. A baseline survey will be performed prior to vegetation clearing, with two follow-up surveys at 6-month intervals to occur after completion of construction.
- *Biosecurity Outreach and Education*. The DON has developed a biosecurity outreach and education program to inform the general public, DoD employees, military personnel, and their dependents regarding native vs. non-native, invasive species, impacts of non-native, invasive species on native species and ecosystems, and what can be done to prevent and control non-native, invasive species. Program materials include an educational brochure, a children's activity booklet, and an associated poster that differentiates native from introduced species, defines invasive species, describes the known impacts of invasive species on native species and ecosystems, and what can be done to prevent and control invasive species.
- *Contractor Education Program*. The DON has developed an education program to ensure construction contractor personnel are informed of the biological resources in the project area, including special-status species, avoidance measures, and reporting requirements.
- *Onsite Vegetation Waste Management Procedures*. Green waste would be handled by the contractors at designated laydown areas within the limits of construction. Contractors will be required to divert all the green waste from disposal and reuse onsite. The larger-sized green waste consisting of trees and stumps will be processed onsite into mulch and the smaller sized green waste will be processed onsite into compost.
- A proposed green waste processing facility at Naval Base Guam landfill may also be used to process green waste generated during construction. The DoD will seek permit authorization from the GEPA for the proposed green waste processing facility.
- *DON Guam Landscaping Guidelines*. The DON has developed a manual providing landscaping design guidelines specific to appropriate plant selection and establishment for all DON construction activities on Guam (NAVFAC Pacific 2011). This manual implements required DON policies including, but not limited to:
    - use native regional plants for landscaping;
    - design, use, and promote construction practices that minimize adverse effects on natural habitat;
    - prevent pollution by reducing fertilizer and pesticide use, integrated pest management practices, recycling green waste (composting), and minimizing runoff;
    - implement efficient water practices; and
    - prevent the introduction of invasive species.
- *Contractor Plans and Specifications*. All construction would occur within the limits of construction shown in the project figures.

Potential Mitigation Measures

To mitigate for significant impacts to limestone forest, the DON proposes to implement forest enhancement on a minimum of 1,007 acres (408 ha) of limestone forest. Forest enhancement would include but is not limited to the following actions:

- Ungulate management consisting of exclusion fencing and active control (i.e. trapping, snaring, shooting) with the goal of eradication within the fenced areas.
- Non-native, invasive vegetation removal.
- Propagation, planting, and establishment of native species that are characteristic of native limestone forest habitats (e.g., *A. mariannensis, G. mariannae, F. prolixa, M. citrifolia, W. elliptica*).
- The degradation and loss of primary limestone and other forest habitats resulting from ungulate damage and invasion by alien plant species has substantially diminished the extent of habitat for native species in the Mariana archipelago. The anticipated benefit of implementing these potential mitigation measures is improved habitat quality for native flora and fauna, including special-status species. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Terrestrial Conservation Areas. All cantonment/family housing components would be constructed on the upper plateau area of Finegayan. Construction personnel are issued base passes for official business only within proposed construction areas; these restrictions are specified in construction contracts. Use of Haputo ERA is not expected to increase as a result of construction activities; therefore, there would be no impact associated with construction personnel. The Haputo ERA would not be directly impacted and would continue to serve as a migration corridor for species moving or dispersing from AAFB and Finegayan to suitable habitat further south or from these areas to the north.

The only terrestrial conservation area within the impacted areas of Alternative A is Overlay Refuge. Overlay Refuge lands were established for the purpose of conserving and protecting ESA-listed species and other native flora and fauna, maintaining native ecosystems, and the conserving native biological diversity, recognizing that the primary purpose of lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force.

Approximately 1,243 acres (503 ha) of Overlay Refuge lands (Table 4.1.8-3), or 5.8% of the total Overlay Refuge lands on Guam, would be directly impacted under Alternative A. This area overlaps with the vegetation communities discussed previously. The majority (1,179 acres [477 ha]) is associated with the cantonment/family housing component within Finegayan and is comprised primarily of secondary limestone forest (Table 4.1.8-3 and Figure 4.1.8-3). Therefore, because proposed construction activities would convert 1,243 acres (503 ha) of Overlay Refuge lands to developed areas, 184 acres (75 ha) of which is currently developed, this would be a significant loss to the conservation function of these lands and implementation of Alternative A would result in significant but mitigable impacts to terrestrial conservation areas.

Table 4.1.8-3. Impacts to Overlay Refuge with Implementation of Cantonment/Family Housing Alternative A

Project Component	*Overlay Refuge (acres [ha])*						
	PLF	***SLF***	***HS***	***TT***	***CP***	***Dev***	***Total***
Finegayan cantonment/family housing	0.4 (0.2)	879.8 (356.0)	131.5 (53.2)	1.0 (0.4)	0	166.7 (67.5)	**1,179.4 (477.3)**
Utility corridor specific to Alternative A	0	8.3 (3.4)	0	0	0	6.8 (2.8)	**15.1 (6.2)**
Utility corridors and water well areas common to Alternatives A-E	0	38.3 (15.5)	0	0	0	10.5 (4.2)	**48.8 (19.7)**
Total Overlay Refuge Impacted	**0.4 (0.2)**	**926.4 (374.9)**	**131.5 (53.2)**	**1.0 (0.4)**	**0**	**184.0 (74.5)**	**1,243.3 (503.1)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; TT = tangantangan; CP = coconut plantation; CF = *Casuarina* forest; Dev = developed.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on terrestrial conservation areas with implementation of Alternative A. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

The same BMPs discussed above under *Vegetation* would be implemented for terrestrial conservation areas.

Potential Mitigation Measures

To mitigate for significant impacts to terrestrial conservation areas, the DON would submit a proposal to CNO Energy and Environmental Readiness Division to designate an ERA on the NAVMAG to conserve native limestone forest in southern Guam which provides habitat for special-status species. The DON has defined an ERA as a physical area or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural, physical, and biological processes to prevail without human intervention. However, under unusual circumstances, deliberate manipulation (e.g., removal or control of invasive species) may be utilized to maintain the unique feature that the ERA was established to protect (NAVFAC 1996). The proposed NAVMAG ERA would encompass approximately 553 acres (234 ha). Although the proposed NAVMAG ERA is currently part of the Overlay Refuge, implementation of these potential mitigation measures would provide an increased level of protection by further ensuring this area is maintained in natural and near natural conditions and to have available such areas for research and scientific manipulation (NAVFAC 1996; NAVFAC Marianas 2010).

In addition, the DON proposes to submit a proposal to CNO Energy and Environmental Readiness Division to expand the existing Orote ERA by approximately 32 acres (13 ha) of terrestrial habitat. The Final Orote ERA Expansion proposal was completed in FY 2013 and was submitted for approval in 2014.

Wildlife - Native Species. Native bird species reported for Finegayan and support areas on AAFB are predominantly migratory shorebird species and primarily use open areas such as grassy fields. The proposed construction at Finegayan would reduce the amount of these open space areas as the conversion of forested areas to open areas and the proposed construction for utility corridors would result in additional open space. The loss of woody vegetation would result in the loss of nesting areas for the

yellow bittern, but this loss would not result in significant adverse effects on the bittern population on Guam because suitable nesting habitat occurs throughout the island. Short-term construction noise may temporarily impact suitable habitat for some birds in the vicinity of the construction areas, but they would relocate to other open and forested areas on Finegayan and AAFB, and could return to the area following construction. Implementation of Alternative A would not have a significant adverse effect on a population of any migratory bird species or other native wildlife species. Non-listed native reptiles are abundant throughout Guam and impacts to vegetation communities under Alternative A would result in less than significant impacts to non-listed native reptile populations.

Therefore, as presented above, long-term, direct impacts to populations of native wildlife species would not result because these species are abundant in surrounding areas and could repopulate portions of suitable habitat within the affected area after construction. Therefore, direct impacts to native wildlife would be less than significant with implementation of proposed construction activities associated with Alternative A.

Proposed construction activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. To prevent the inadvertent spread of non-native species on Guam or to other locations off of Guam, the DON would implement standard biosecurity measures (e.g., HACCP, brown treesnake interdiction measures, coconut rhinoceros beetle vegetation management procedures, and outreach/education) into construction protocols, procedures, and activities.

The following BMPs would be implemented to avoid and minimize potential direct, long-term impacts of proposed construction activities on native wildlife with implementation of Alternative A.

Best Management Practices

- *HACCP Plan*. See the above discussion of BMPs under *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See the above discussion of BMPs under *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See the above discussion of BMPs under *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. The DoD has a long history of success in preventing the dispersal of the brown treesnake from Guam in its transport of personnel and cargo (USFWS 2010a). After the publication of the 2009 Guam and CNMI Military Relocation Draft EIS, various agencies within the U.S. DOI expressed concern regarding the adequacy of brown treesnake interdiction efforts in response to the relocation of Marine Corps forces to Guam. For the purposes of the 2010 Final EIS and this SEIS, interdiction is defined as: "to hinder, prohibit, or prevent the brown treesnake from becoming established in new locations by conducting inspection and suppression processes." As stated in the 2010 BO (USFWS 2010a), the DON agrees that it will fund any increase of current federally funded brown treesnake interdiction measures (in Guam, CNMI, and Hawaii) where the increase is related to direct, indirect and induced growth caused by the Marine Corps relocation to Guam. The FY 2010 level of funding for the Federal interagency brown treesnake interdiction effort on Guam, CNMI, and Hawaii and 2010 transportation levels associated with outbound cargo from Guam for the U.S. or U.S. territories will be used as the baseline. That funding will continue and become part of the DON's brown treesnake interdiction funding under authority of the Brown Tree Snake Control and Eradication Act (7 USC § 8501 note) (USFWS 2010a).

JRM has established a comprehensive brown treesnake interdiction program to ensure that military activities, including the transport of civilian and military personnel and equipment to and from Guam, do not contribute to the spread of brown treesnakes to other islands or regions. Brown treesnake interdiction requirements (e.g., trapping and inspections at ports and cargo facilities, aircraft, inspections of household good movements, biosecurity plans for training events) are specified in DoD instructions (i.e., 36 Wing Instruction 32-7004, *Brown Tree Snake Control Plan* and COMNAVMAR Instruction 5090.10A, *Brown Tree Snake Control and Interdiction Plan*) as well as the annual Work Financial Plan that is developed in cooperation with USDA Wildlife Services. The proposed action would continue to comply with these established procedures.

As stated in the 2010 BO, the U.S. DOI agrees that it is not the DON's responsibility to fund increased interdiction measures that are identified more than 1 year after the end of the fiscal year in which both Marine Corps relocation construction has ended and the permanent non-transient Marine Corps units have relocated to Guam.

Since the signing of the original BO on 2010, the DON has worked with USDA and USFWS to determine brown treesnake interdiction cost increases. To date, there has been no measurable increase in interdiction costs according to USDA.

- *Brown Treesnake Rapid Response*. Brown treesnake management, research, and coordination efforts have been refined and progressed to the point where USDA APHIS WS inspection rates for cargo and flights departing Guam are almost 100% and it has been two decades since a live brown treesnake was detected in Hawaii (Brown Treesnake Technical Working Group 2014). The DON fully supports implementation of brown treesnake rapid response that is currently provided for in the Mariana Islands Range Complex (MIRC) BO (USFWS 2010c).

With implementation of these BMPs, including development of HACCP plans and ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species, the risk of the introduction and establishment of new or spread of existing non-native species on Guam is substantially reduced. Therefore, there would be less than significant impacts to native wildlife species related to the potential introduction and establishment of non-native species with implementation of proposed construction activities associated with Alternative A.

Damage of forested areas, particularly primary and secondary limestone forests, by non-native ungulates (i.e., deer and pigs) is a serious concern on Guam. Under Alternative A, removal of large amounts of secondary limestone forest currently used by ungulates would displace and concentrate ungulates into adjacent areas, resulting in even higher densities and potentially greater habitat damage. Potential impacts from changes in ungulate densities from construction projects within the same or similar habitat areas as proposed in this SEIS were addressed in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-115).

In addition, the implementation of the potential mitigation measures discussed above under the *Vegetation* section would also benefit native wildlife species. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. Approximately 957 acres (387 ha) of Mariana fruit bat recovery habitat would be removed due to proposed construction activities at Finegayan and support areas on AAFB under

Alternative A (Table 4.1.8-4). See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.1.8-4. Summary of Permanent Construction-Related Impacts to Mariana Fruit Bat Recovery Habitat with Implementation of Cantonment/Family Housing Alternative A

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment/family housing	900.5 (364.4)
Utility corridor specific to Alternative A	7.6 (3.1)
Utility corridors and water well areas common to Alternatives A-E	48.4 (19.6)
Total Recovery Habitat Impacted	**956.5 (387.1)**

Additional potential direct temporary impacts to the Mariana fruit bat from construction activities are based on the distances from those activities that are likely to cause disturbance to this species (e.g., noise, human activity, lighting). The evaluation of fruit bat disturbance is based on the approach used by USFWS in previous ESA section 7 formal consultations and associated BOs (e.g., USFWS 2006b, 2010a). These distances are: roosting habitat within 492 feet (150 m) and foraging habitat within 328 feet (100 m) from the activity (Wiles, personal communication 2006 and Janeke, personal communication 2006, respectively, as cited in USFWS 2006b).

There are no historical fruit bat roost sites at Finegayan and there have been only two observations of fruit bats on or adjacent to Finegayan since the 1990s (Wiles *et al.* 1995; Brooke 2008). However, there is fruit bat recovery habitat within the Alternative A impacted areas as well as the Haputo ERA immediately adjacent to Finegayan. As fruit bats are known to occur on AAFB to the north and have been observed within and adjacent to Finegayan (i.e., the HMU), it is highly likely that fruit bats use the Haputo ERA for foraging and possibly roosting.

The species is currently limited to the few areas on Guam away from human activities and with suitable habitat, primarily on the NAVMAG and AAFB (JRM *et al.* 2012a, 2012b; JRM 2013; A. Brooke, NAVFAC Marianas, personal communication). However, illegal hunting, loss and degradation of native forest, predation by the brown treesnake, and the increased extirpation risk owing to the high vulnerability of very small populations continue to limit the potential recovery of the species on Guam (USFWS 2010a; JRM 2013). Based on the equilibrium/carrying capacity of snakes on Guam (Rodda and Savidge 2007), implementation of the proposed action is not expected to increase the likelihood of predation by the brown treesnake on Mariana fruit bats.

Although the loss of 957 acres (387 ha) of fruit bat recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, it would reduce the total number of bats that the island can support. Given this loss of recovery habitat and the critically low numbers of bats on Guam, there would be significant but mitigable impacts to the Mariana fruit bat.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on Mariana fruit bats with implementation of Alternative A. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See the above discussion of BMPs under *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See the above discussion of BMPs under *Vegetation* for a detailed description of biosecurity outreach and education.

- *Contractor Education Program*. See the above discussion of BMPs under *Vegetation* for a detailed description of the contractor education program.
- *Pre-Construction Surveys*. Surveys would be completed within suitable fruit bat habitat 1 week prior to onset of construction activities following the USFWS-approved JRM protocol. If a fruit bat is present within 492 feet (150 m) of the project site, the work must be postponed until the bat has left the area.
- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all new roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

Potential Mitigation Measures

The same potential mitigation measures discussed previously under *Vegetation* (i.e., forest enhancement of 1,007 acres [408 ha] of limestone forest) would be applicable for the Mariana fruit and its recovery habitat. The anticipated benefit of implementing these potential mitigation measures is improved habitat quality for native flora and fauna, including the Mariana fruit bat. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

MARIANA CROW. The Mariana crow is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the crow is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the crow, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative A, impacts to the crow would be limited to recovery prospects. If crows are reintroduced and exposed to construction activities under Alternative A, they may be disturbed (DON 2014).

Although the crow no longer occurs on Guam, approximately 957 acres (387 ha) of crow recovery habitat would be removed due to proposed construction activities at Finegayan and the AAFB support areas under Alternative A (Table 4.1.8-5). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.1.8-5. Summary of Permanent Construction-Related Impacts to Mariana Crow Recovery Habitat with Implementation of Cantonment/Family Housing Alternative A

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment/family housing	900.5 (364.4)
Utility corridor specific to Alternative A	7.6 (3.1)
Utility corridors and water well areas common to Alternatives A-E	48.4 (19.6)
Total Recovery Habitat Impacted	**956.5 (387.1)**

Although this loss of recovery habitat on Guam would not preclude the recovery of the crow should it be reintroduced to Guam in the future, it would reduce the total number of crows that the island can support. If and when the crow is reintroduced to Guam, the best available information indicates project-related noise would not further reduce the amount of recovery habitat suitable for this species' breeding, feeding

and sheltering (USFWS 2010a). Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Mariana crow.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of the Mariana crow with implementation of Alternative A. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See the above discussion of BMPs under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See the above discussion of BMPs under *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See the above discussion of BMPs under *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See the above discussion of BMPs under Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. The DON would implement selected projects identified as priorities in the Brown Treesnake Technical Working Group Strategic Plan that are compatible with the military mission on Guam for up to 10 years from the start of cantonment construction, subject to Congressional funding guidelines and restrictions.

  The DON's intent with these projects would be to identify and use successful technology to severely suppress or eradicate brown treesnakes. Dependent upon the success of current experimental suppression activities within the HMU, the DON would install a brown treesnake barrier to exclude brown treesnakes from approximately 160 acres (65 ha). If the DON is successful at eradicating brown treesnakes within these 160 acres (65 ha), the DON would install a second brown treesnake barrier to exclude brown treesnakes from approximately 300 acres (121 ha). If either the HMU project or the 160-acre (65-ha) exclosure is deemed unsuccessful, the DON would work with the USFWS to identify other equivalent projects from the Brown Treesnake Technical Working Group Strategic Plan to implement in lieu of brown treesnake exclosures.

  In response to decreased brown treesnake densities resulting from suppression efforts listed above, rodent and feral cat populations are expected to increase. In order to address this anticipated increase the DON would implement rodent and feral cat control as necessary. Rodent control would also benefit vegetation and other special-status species. Feral cat control would benefit the recovery of special-status bird species as cats prey on native birds.

- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 1,007 acres [408 ha] of limestone forest) would be applicable for Mariana crow recovery habitat. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana crow, should it be reintroduced to Guam in the future. Forest enhancement would also support natural

regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

GUAM RAIL. The Guam rail is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the rail is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the rail, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the rail is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative A, impacts to the rail would be limited to recovery prospects. If rails are reintroduced and exposed to construction activities under Alternative A, they may be disturbed (DON 2014).

Although the rail no longer occurs on Guam, approximately 500 acres (202 ha) of rail recovery habitat would be removed due to proposed construction activities at Finegayan and the AAFB support areas under Alternative A (Table 4.1.8-6). See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.1.8-6. Summary of Permanent Construction-Related Impacts to Guam Rail Recovery Habitat with Implementation of Cantonment/Family Housing Alternative A

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment/family housing	431.2 (174.5)
Utility corridor specific to Alternative A	16.8 (6.8)
Utility corridors and water well areas common to Alternatives A-E	51.8 (21.0)
Total Recovery Habitat Impacted	**499.8 (202.3)**

Although this loss of recovery habitat on Guam would not preclude the recovery of the rail should it be reintroduced to Guam in the future, it would reduce the total number of rails that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam rail.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of the Guam rail with implementation of Alternative A. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See the above discussion of BMPs under Construction, *Vegetation* for a detailed description of the HACCP planning.
- *Biosecurity Outreach and Education*. See the above discussion of BMPs under *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See the above discussion of BMPs under *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See the previous discussion of Mariana crow mitigation measures for a detailed description of the brown treesnake research program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 1,007 acres [408 ha] of limestone forest) would be applicable for Mariana

crow recovery habitat. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana crow, should it be reintroduced to Guam in the future. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

GUAM MICRONESIAN KINGFISHER. The kingfisher is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the kingfisher is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the kingfisher, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the kingfisher is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative A, impacts to the kingfisher would be limited to recovery prospects. If kingfishers are reintroduced and exposed to construction activities under Alternative A, they may be disturbed (DON 2014).

Although the kingfisher no longer occurs on Guam, approximately 957 acres (387 ha) of kingfisher recovery habitat would be removed due to proposed construction activities at Finegayan and the AAFB support areas under Alternative A (Table 4.1.8-7). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.1.8-7. Summary of Permanent Construction-Related Impacts to Guam Micronesian Kingfisher Recovery Habitat with Implementation of Cantonment/Family Housing Alternative A

Project Component	***Recovery Habitat (acres [ha])***
Finegayan cantonment/family housing	900.5 (364.4)
Utility corridor specific to Alternative A	7.6 (3.1)
Utility corridors and water well areas common to Alternatives A-E	48.4 (19.6)
Total Recovery Habitat Impacted	**956.5 (387.1)**

Although this loss of recovery habitat on Guam would not preclude the recovery of the kingfisher should it be reintroduced to Guam in the future, it would reduce the total number of kingfishers that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam Micronesian kingfisher.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of the Guam Micronesian kingfisher with implementation of Alternative A. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See the above discussion of BMPs under Construction, *Vegetation* for a detailed description of the HACCP planning.
- *Biosecurity Outreach and Education*. See the above discussion of BMPs under *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See the above discussion of BMPs under *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See the previous discussion of Mariana crow mitigation measures for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 1,007 acres [408 ha] of limestone forest) would be applicable for Mariana crow recovery habitat. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana crow, should it be reintroduced to Guam in the future. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

SEA TURTLES. The green and hawksbill sea turtles potentially nest along the Haputo ERA beach. All cantonment/family housing components would be constructed on the upper plateau area of Finegayan and would not occur in the Haputo ERA or adjacent to the beach. Construction personnel are issued base passes for official business only within proposed construction areas; these restrictions are specified in construction contracts. Use of Haputo ERA is not expected to increase as a result of construction activities; therefore, there would be no impacts from construction personnel to sea turtles that may occur on the Haputo ERA beach.

To avoid and minimize any potential impacts to nesting sea turtles from proposed facility lighting associated with the construction of the cantonment/family housing area at Finegayan, hooded lights would be used to the maximum extent practicable at all new roads and facilities near coastline areas. Illumination of coastline areas would be kept to an absolute minimum. The implementation of the potential mitigation measures described above under *Vegetation* would also benefit the survival of sea turtles. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Therefore, there would be no impacts to potential nesting sea turtles within the Haputo ERA with implementation of the proposed construction activities associated with Alternative A.

TREE SNAILS. The three ESA-proposed endangered species of tree snails only occur within the Haputo ERA. All cantonment/family housing components would be constructed on the upper plateau area of Finegayan and would not occur in the Haputo ERA. Construction personnel are issued base passes for official business only within proposed construction areas; these restrictions are specified in construction contracts. Use of Haputo ERA is not expected to increase as a result of construction activities; therefore, there would be no impacts from construction personnel to tree snails that occur within the Haputo ERA. Therefore, there would be no impacts to tree snails occurring within the Haputo ERA with implementation of the proposed construction activities associated with Alternative A.

The implementation of the potential forest enhancement mitigation measures described above for the Mariana crow would also benefit the survival of tree snails. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species.

MARIANA EIGHT-SPOT BUTTERFLY. The two known host plant species for the eight-spot butterfly have not been reported within the proposed project area and there are no records of the species within the AAFB support areas. However, given the proximity of the eight-spot butterfly area to Finegayan (see Figure 4.1.8-4) and the high mobility of the species, the species is likely to occur within the larger Finegayan area.

Some species of tropical butterflies have well-developed ears on their wings and can detect sounds at the same frequencies that humans can hear. It is hypothesized that the butterflies are listening to the flight sounds or foraging calls of predatory birds (Lane *et al.* 2008; Yack 2012). Given the low numbers of forest birds currently on Guam due to the brown treesnake, masking of the flight sounds or foraging calls of predatory birds due to noise from proposed construction activities would not make eight-spot butterflies more susceptible to predation.

With implementation of appropriate BMPs to avoid and minimize potential impacts to eight-spot butterflies (e.g., pre-construction butterfly and host plant surveys within the proposed construction footprint and salvage/relocation of host plants, larvae or eggs; see Section 2.8), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed construction activities associated with Alternative A. In addition, implementation of the potential mitigation measures described above under *Vegetation* (i.e., forest enhancement of 1,007 acres [408 ha] of limestone forest) would also benefit the survival the eight-spot butterfly. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species, including eight-spot butterfly host plants.

DENDROBIUM GUAMENSE AND *TUBEROLABIUM GUAMENSE*. There is a known single occurrence of each species within the northeastern portion of Finegayan. Both species would be salvaged to the maximum extent practicable and translocated to suitable habitat (see Section 2.8). With the implementation of BMPs, such as potential translocation of *D. guamense* and *T. guamense* to suitable habitat, there would be less than significant impacts to both species with implementation of the construction activities associated with Alternative A. In addition, the implementation of the potential mitigation measures under the *Vegetation* section above would also benefit the survival of these orchid species. In particular ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

TABERNAEMONTANA ROTENSIS. Two clusters of *T. rotensis* are located within the eastern portion of the potential water well development impacted area on AAFB. Under Alternative A, all *T. rotensis* would be avoided to the maximum extent practicable during proposed construction activities. If they cannot be avoided, *T. rotensis* saplings would be salvaged to the maximum extent practicable and translocated to suitable habitat (see Section 2.8). In addition, given that 265 clusters of plants have been documented on AAFB (UoG 2007) and only 2 clusters of plants have been observed within proposed impacted areas, the loss of 2 clusters of plants would be a less than significant impact to *T. rotensis* with implementation of the proposed construction activities associated with Alternative A.

CYCAS MICRONESICA. Although the cycad has not been observed within the impacted areas during biological resources surveys in support of the 2010 Final EIS or this SEIS, the cycad does occur in secondary limestone forest, the dominant vegetation community within the proposed impacted areas under Alternative A. With the implementation of BMPs, such as avoidance of cycads to the maximum extent practicable during construction activities and potential translocation of cycads to suitable habitat (see Section 2.8), which has been proven successful, there would be less than significant impacts to *C. micronesica* with implementation of the construction activities associated with Alternative A. In addition, the implementation of the potential mitigation measures under the *Vegetation* section above would also benefit the survival of the cycad. In particular ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

SERIANTHES TREE. Although individual *Serianthes* trees do not occur within the impacted areas of Alternative A, approximately 634 acres (257 ha) of *Serianthes* recovery habitat would be removed due to

proposed construction activities at Finegayan and the AAFB support areas under Alternative A (Table 4.1.8-8). See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.1.8-8. Summary of Direct Construction-Related Impacts to *Serianthes* Recovery Habitat with Implementation of Cantonment/Family Housing Alternative A

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment/family housing	587.0 (237.6)
Utility corridor specific to Alternative A	6.4 (2.6)
Utility corridors and water well areas common to Alternatives A-E	40.3 (16.3)
Total Recovery Habitat Impacted	**633.7 (256.5)**

Although this loss of recovery habitat on Guam would not preclude the recovery of *Serianthes*, this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of *Serianthes* on Guam.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of *Serianthes* with implementation of Alternative A. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See the above discussion of BMPs under *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See the above discussion of BMPs under *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See the above discussion of BMPs under *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 1,007 acres [408 ha] of limestone forest) would be applicable for *Serianthes* recovery habitat. In particular, the objectives of ungulate management, rodent control, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for *Serianthes*. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Special-Status Species: Guam-Listed and SOGCN

MICRONESIAN STARLING. As this species is rarely recorded from Finegayan and in the impacted area on AAFB associated with the support areas of Alternative A, there would be no impacts to the starling with implementation of proposed construction activities associated with Alternative A.

WHITE-THROATED GROUND DOVE. Although considered extirpated from Guam since the 1980s, the white-throated ground dove has been observed on AAFB on rare occasions (JRM *et al.* 2012a, b; NAVFAC Marianas 2013b). The primary cause of its extirpation and lack of reestablishment on Guam is due to predation by the brown treesnake (GDAWR 2006). It has not been reported in the proposed

impacted areas associated with Alternative A, only in other areas on AAFB including the MSA and the southeastern corner of AAFB. Therefore, there would be no impacts to the white-throated ground dove with implementation of the construction activities associated with Alternative A.

MOTH SKINK AND PACIFIC SLENDER-TOED GECKO. The moth skink and Pacific slender-toed gecko are listed by Guam as endangered. These two species are threatened primarily by introduced species (e.g., feral ungulates, curious skinks, musk shrews, rats, brown treesnakes, and feral cats) and loss of limestone forest habitat. Both species were detected in the northeastern corner of Finegayan and within a proposed utility corridor along the south-central area of AAFB within secondary limestone forest that would be directly impacted under Alternative A (see Figures 4.1.8-4 and 4.1.8-5). The full extent of the distribution and abundance of these species throughout Guam has not been assessed. The loss of approximately 1,007 acres [408 ha) of occupied limestone forest habitat for both the skink and gecko would be a significant but mitigable impact.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct long-term impacts of proposed construction activities on the moth skink and slender-toed gecko with implementation of Alternative A. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See the previous discussion of BMPs under *Vegetation* for a detailed description of the HACCP planning.
- *Brown Treesnake Interdiction*. See the previous discussion of BMPs under *Vegetation* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

The potential forest enhancement mitigation measures described above in the Vegetation section would also result in a conservation benefit to the moth skink and slender-toed gecko. The proposed brown treesnake research and suppression may also benefit these two species. See the potential mitigation discussions for the Mariana crow, Micronesian kingfisher, and the Guam rail for more information.

Operation

Operational impacts would only occur for the proposed cantonment/family housing at Finegayan. Operational requirements for the proposed utilities would require only periodic, limited maintenance activities along established utility corridors and impacts to biological resources would be less than significant. Consequently, only the potential operational impacts at the proposed Finegayan cantonment/family housing area are evaluated below.

Vegetation. With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, 1-year post construction monitoring to evaluate effectiveness of HACCP, and applicable elements of the Strategic Implementation Plan (SIP), the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the proposed Alternative A is considered unlikely. The DON recognizes the USFWS' ongoing concern regarding potential spread of the brown treesnake. The DON will consult with USFWS under ESA section 7 to determine if additional brown treesnake interdiction measures are warranted and

applicable. Therefore, there would be less than significant impacts to vegetation with operation of the proposed Alternative A.

Terrestrial Conservation Areas. After construction of the cantonment/family housing areas under Alternative A, the majority of remaining designated Overlay Refuge area on Finegayan would be developed. Therefore, operational activities associated with Alternative A are expected to result in less than significant impacts to the remaining Overlay Refuge lands on Finegayan.

All cantonment/family housing components would be located on the upper plateau area of Finegayan and not within the Haputo ERA. However, potential increased usage of the Haputo ERA by military and civilian personnel associated with the proposed cantonment/family housing facilities at Finegayan would result in significant but mitigable impacts to the Haputo ERA.

Potential Mitigation Measures

The following measures may be implemented to mitigate potential direct, long-term impacts of proposed operational activities on the Haputo ERA with implementation of Alternative A.

- Fencing of the Haputo ERA access trail to control and manage access.
- Development and installation of informational and educational signage.
- Development of educational materials for military and civilian personnel on the sensitive biological resources within the Haputo ERA.
- Monitoring of visitor use.

Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent overuse and potential damage to terrestrial biological resources. These measures are consistent with the goals and objectives of the Haputo ERA Management Plan (NAVFAC Marianas 2010).

Wildlife - Native Species. Potential impacts to wildlife were evaluated in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-101) for a similar proposed action but impacting a larger area, and were found to be less than significant.

Lighting along the perimeter of Alternative A would be hooded or shielded to the maximum extent practicable to prevent unnecessary light beyond operational areas. Proposed operational activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. The following BMPs would be implemented to avoid and minimize potential indirect, long-term impacts of proposed operational activities on native wildlife with implementation of Alternative A.

Best Management Practices

- *Biosecurity Outreach and Education*. See the previous discussion of BMPs under construction impacts to *Vegetation* for a detailed description of Biosecurity Outreach and Education.
- *Brown Treesnake Interdiction*. See the previous discussion of BMPs under construction impacts to *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.
- *Prevention of Free-Roaming Cats and Dogs*. With the establishment of the cantonment/family housing areas on Finegayan with the associated military and civilian personnel and their dependents, there is the potential for an increased presence of pet cats and dogs that could result in increased predation of native wildlife species. Per DON policy, dogs, cats, and other privately owned or stray animals are not permitted to run at large on military installations. Installation

personnel are required to keep and feed all pets indoors or under close supervision when outdoors (on leash and collar or within a cage, fenced yard). This policy is specified in Secretary of the Navy Instruction 6401-1A, *Veterinary Health Services* (August 16, 1994); OPNAVINST 6250.4b, *Pest Management Programs* (August 27, 1998); and CNO Policy Letter *Preventing Feral Cat and Dog Populations on Navy Property*, 5090 Ser N456M/1U595820 (January 10, 2002). The proposed action would comply with these established policies.

With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the proposed Alternative A is considered unlikely. Therefore, there would be less than significant impacts to native wildlife species with operation of the proposed cantonment/family housing at Finegayan under Alternative A.

Continued implementation of the potential mitigation measures under the Construction, *Vegetation* and *Special-status Species* sections above would also benefit native wildlife species and habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species. The implementation of the potential mitigation measures under the *Terrestrial Conservation Areas* section above would also benefit native wildlife species. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to native wildlife species within the Haputo ERA. Therefore, there would be less than significant impacts to native wildlife species related to the introduction and establishment of non-native species due to operational activities associated with Alternative A.

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. Potential impacts to the Mariana fruit bat from operational activities are based on the distances from operations that are likely to cause disturbance to this species (e.g., noise, lighting, and general human disturbance). These are the same distances that were previously discussed for construction impacts. This acreage of fruit bat recovery habitat would continue to be impacted from operational activities of the cantonment/family housing area at Finegayan after construction activities have ceased.

There are no historical fruit bat roost sites at Finegayan and there have been only two observations of fruit bats on or adjacent to Finegayan since the 1990s (Wiles *et al.* 1995; Brooke 2008). However, there is fruit bat recovery habitat within the Alternative A impacted areas as well as the Haputo ERA immediately adjacent to Finegayan. As fruit bats are known to occur on AAFB to the north and have been observed within and adjacent to Finegayan (i.e., the HMU), it is highly likely that fruit bats use the Haputo ERA for foraging and possibly roosting.

Operation of the proposed Alternative A would result in significant but mitigable impacts to fruit bats due to potential direct disturbance (e.g., noise, lighting, and general human disturbance) to fruit bats within 150 meters of the cantonment/family housing area. The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential long-term impacts of proposed operational activities on the Mariana fruit bat with implementation of Alternative A.

Best Management Practices

- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all roads

and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

Potential Mitigation Measures

- Continued implementation of the potential mitigation measures under the Construction, *Vegetation* and *Special-status Species* sections above would also benefit Mariana fruit bat and recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species. The implementation of the potential mitigation measures under the *Terrestrial Conservation Areas* section above would also benefit Mariana fruit bat and recovery habitat. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to fruit bats within the Haputo ERA.

MARIANA CROW, GUAM RAIL, AND GUAM MICRONESIAN KINGFISHER. These species are extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of these species is reasonably certain to occur and the species are likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of these species, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow, rail, and kingfisher are successfully re-introduced and then have the potential to be exposed to cantonment/family housing operational activities under Alternative A, there would be no impact to these species. If the species are reintroduced and exposed to cantonment/family housing operational activities under Alternative A, they may be disturbed.

SEA TURTLES. Potential impacts to sea turtles were evaluated for a similar, but larger proposed action in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, NCTS and South Finegayan; page 10-118), and were found to be less than significant and would continue to be less than significant with implementation of this alternative. Two suspected nest attempts by green sea turtles have been observed at Haputo Beach between 2008 and 2010, with no observations of nest attempts during 51 surveys from 2010 to 2012 (Grimm and Farley 2008; NAVFAC Marianas 2011; Brindock 2012).

As discussed previously under construction impacts, to avoid and minimize any potential impacts to nesting and potential hatchling sea turtles from proposed facility lighting at Finegayan, hooded lights would be used to the maximum extent practicable at all new roads and facilities near coastline areas. Illumination of coastline areas would be kept to an absolute minimum.

The implementation of the potential mitigation measures under the *Vegetation* and *Terrestrial Conservation Areas* sections above would benefit the survival of sea turtles (e.g., reducing erosion, reducing nest predation by rodents). In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Pets are not permitted at Haputo ERA. This policy would prevent potential impacts to nesting sea turtles from harassment, injury or mortality from pets. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to nesting sea turtles that may potentially use Haputo Beach.

Given the low probability of sea turtle nesting at Haputo Beach combined with implementation of potential mitigation measures for *Vegetation*, *Terrestrial Conservation Areas* and *Wildlife-Native Species*,

impacts resulting from the proposed action would be less than significant to nesting sea turtles at Haputo Beach within the Haputo ERA with implementation of the operational activities associated with Alternative A.

MARIANA EIGHT-SPOT BUTTERFLY. Mariana eight-spot butterflies and its host plants are known to occur within the Haputo ERA, but not within the impacted areas of Finegayan (see Figure 4.1.8-4). With the exception of periodic fence maintenance in the northern portion of Haputo ERA near the known butterfly area, there would be no operational impacts to butterflies or host plants with implementation of Alternative A.

TREE SNAILS. Three species of tree snails, all proposed for federal listing as endangered, are present along the coast in the Haputo ERA. Potential impacts to tree snails at Haputo ERA were evaluated for a similar, but larger proposed action in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-118). Potential impacts to tree snails at the Haputo ERA due to operations associated with Alternative A would be less than significant. Implementation of the potential mitigation measures discussed below would provide additional benefits to tree snails.

The implementation of the potential mitigation measures under the *Vegetation* and *Terrestrial Conservation Areas* sections above would also benefit tree snails. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the potential forest enhancement mitigation measures. There is the potential for impacts to tree snails within the Haputo ERA from disturbance of vegetation and collecting and handling of tree snails due to increased usage of the ERA by military and civilian personnel associated with Alternative A. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to tree snail species and their habitat within the Haputo ERA.

SERIANTHES TREE, *TABERNAEMONTANA ROTENSIS*, AND *CYCAS MICRONESICA*. There would be no impacts to *Serianthes* and its associated recovery habitat, *T. rotensis*, and *C. micronesica* due to operations associated with Alternative A. The implementation of the potential mitigation measures under the *Terrestrial Conservation Areas* section above would also benefit special-status plant species. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to special-status plant species within the Haputo ERA.

DENDROBIUM GUAMENSE AND *TUBEROLABIUM GUAMENSE*. After proposed construction of Alternative A facilities and infrastructure, there would be no known occurrences of either species within Finegayan or AAFB support areas associated with Alternative A. Therefore, there would be no impacts to both species with implementation of Alternative A operations.

Special-Status Species: Guam-Listed and SOGCN

MICRONESIAN STARLING. As this species is rarely recorded from Finegayan and in the impacted area on AAFB associated with the support areas of Alternative A, there would be no impacts to the starling due to operations associated with Alternative A.

WHITE-THROATED GROUND DOVE. The white-throated ground dove has not been reported in Finegayan or AAFB support areas and is considered extirpated from Guam; however, there are rare occurrences of transient individuals from Rota. Therefore, there would be no impacts to the white-throated ground dove due to operations associated with Alternative A.

MOTH SKINK AND PACIFIC SLENDER-TOED GECKO. There would be no impacts to the moth skink or slender-toed gecko due to operations associated with Alternative A. The implementation of the potential mitigation measures under the *Terrestrial Conservation Areas* section above would also benefit the skink and gecko. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to these species and their habitat within the Haputo ERA.

4.1.9 Marine Biological Resources

4.1.9.1 Affected Environment

The affected environment for marine resources associated with the Finegayan cantonment/family housing alternative (Alternative A) is found in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1: Affected Environment, pages 11-1 to 11-68), but it is summarized below for reference. This summary of the affected environment is supplemented with new information regarding the ESA listing of four coral species as threatened that occur around Guam and the ESA listing of the Indo-West Pacific Distinct Population Segment of the scalloped hammerhead shark as threatened.

The reduction in the number of Marines and dependents that would be relocated to Guam from the originally planned 8,600 Marines and 9,000 dependents to approximately 5,000 Marines and approximately 1,300 dependents does not result in any changes to the affected environment for marine resources, but it may further decrease some potential impacts to marine resources determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, and is therefore incorporated in the subsequent analysis of environmental consequences for the alternatives below. These analyses are categorized into the following subcategories as in the 2010 Final EIS: marine flora and invertebrates, fish, EFH, special-status species, and marine conservation areas. The affected environment for facilities common to all alternatives (i.e., school expansions, off-site utilities) is onshore and not relevant to the assessment of marine biological resources.

Marine Flora and Invertebrates

Benthic habitat around Finegayan generally progresses from nearshore to offshore as macroalgae, coralline algae, coral (10-50% coral coverage), turf algae, and unconsolidated sediment. Immediately west of Finegayan is the Haputo ERA, including Double Reef (also known as Pugua Patch Reef), which is advertised as a popular dive site and is named in the Haputo ERA Management Plan as an area of high coral cover. Double Reef is therefore a coral area of significance (Figure 4.1.9-1). The reef front of Haputo Beach consists of high coral cover with a dominance of faviid and mussid coral colonies. No other site on Guam has been reported where such large (non-*Porites* species) coral heads are dominant.

This area has a relatively high abundance of cyanobacteria, which may be the result of increased nutrient concentrations or reef degradation, such as that caused by crown-of-thorns outbreaks. Additional information is found in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.5.2: Finegayan, page 11-46).

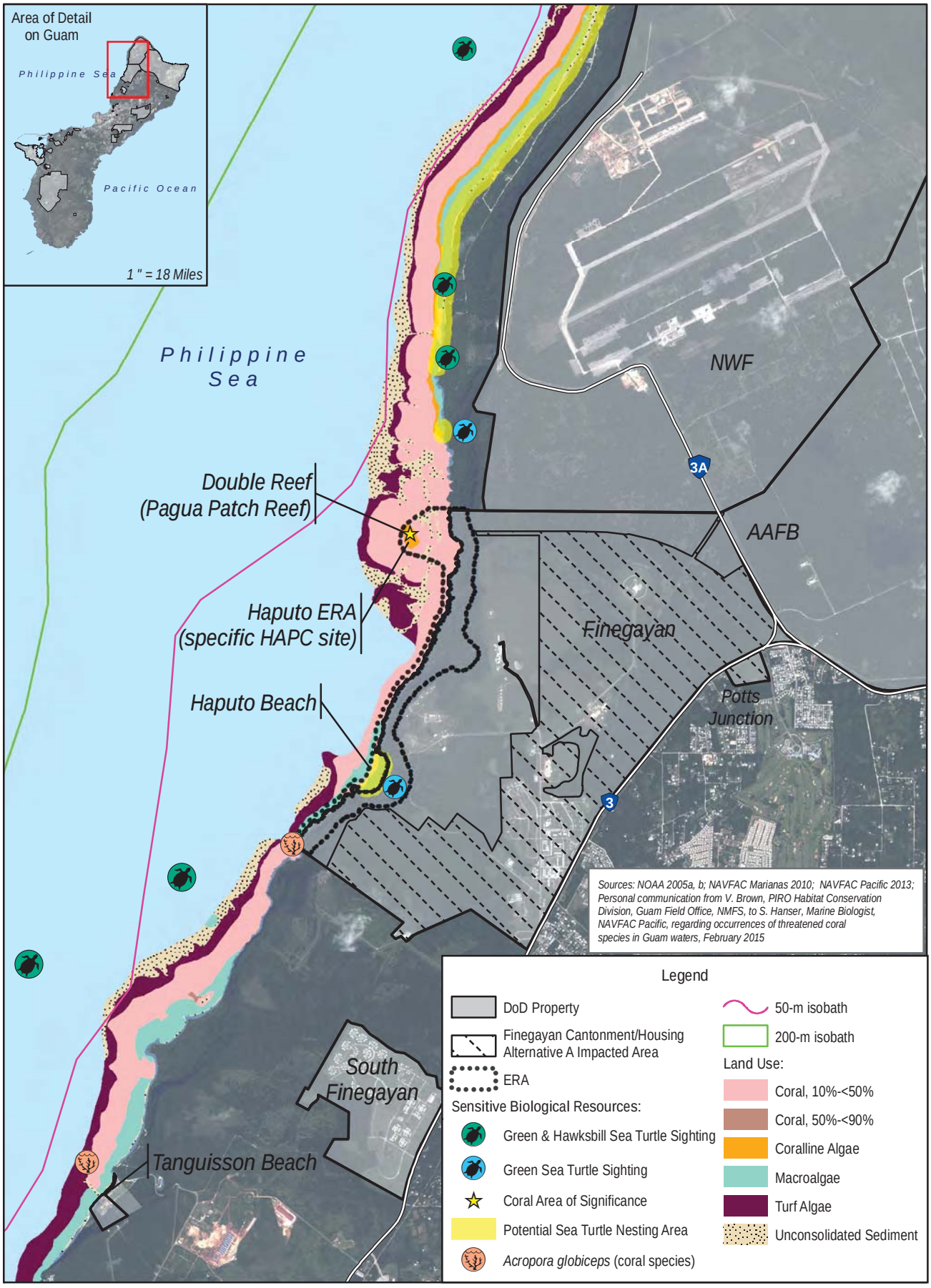


Figure 4.1.9-1
Overview of Sensitive Marine Biological Resources and Nearshore Habitat - Finegayan Cantonment/Housing Alternative A

Fish

The extent to which the coastal waters off Finegayan are used for commercial, recreational or subsistence fishing has not been determined. However, NOAA reported that, as of 2006, there was no evidence of shallow-water bottomfish overfishing around Guam (71 FR 64474, November 2, 2006). Additionally, within the Haputo ERA, there have been no indications that fish abundance or composition has declined or changed, according to surveys conducted in 2001 and 2008 (USFWS 1988; Amesbury *et al.* 2001; SWCA 2009 [as cited in SWCA 2010]). The Haputo ERA acts as a nursery for fish species of subsistence and commercial value, supported by Double Reef, one of Guam's few remaining examples of a healthy leeward fringing reef community (2010 Final EIS, Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.5.2).

Essential Fish Habitat

EFH-designated habitat areas for Finegayan are those defined for bottomfish, crustaceans, coral reef ecosystems, precious corals, and Pacific pelagics (Figure 4.1.9-1). Several areas within the designated EFH near Finegayan host coral reefs with high coral cover and diversity relative to most of Guam, for which coral cover averages less than 20%. For example, Double Reef averages 46% coral cover and has high coral diversity (i.e., 60% of the known coral fauna of Guam was encountered during a limited survey on a short reef section in the area around Finegayan) (Amesbury *et al.* 2001).

Special-Status Species

Special-status species that may potentially occur within the project area include: three threatened coral species (*Acropora globiceps* and *Seriatopora aculeata*), threatened green and endangered hawksbill turtles, and bumphead parrotfish, a species of concern.

Acropora globiceps has been observed and *Seriatopora aculeata* is likely to occur in the waters of Haputo ERA based on observations of the species in other areas of Guam with similar habitats (Table 4.1.9-1) (Burdick 2012, 2013).

Table 4.1.9-1. Coral Species Listed as Threatened under the ESA Potentially Occurring or Known to Occur within the Haputo ERA

Scientific Name	*Abundance/Habitat*	*Comments*
Acropora globiceps	Not Available	Occurs in Guam waters. One occurrence at southern boundary of Haputo ERA and one occurrence 2.2 miles (3.5 km) south of Haputo ERA approximately 1,083 feet (330 m) offshore of Tanguisson Beach (Figure 4.1.9-1).
Seriatopora aculeata	Rare to uncommon, typically found in exposed seaward reef slope zones.	Typically occurs in areas where sedimentation rates are low; however, noted in Guam waters along the southwestern coast where sedimentation rates were high.

Sources: Burdick 2012, 2013; Personal communication from V. Brown, Pacific Islands Regional Office Habitat Conservation Division, Guam Field Office, NMFS, to S. Hanser, Marine Biologist, NAVFAC Pacific regarding occurrences of threatened coral species in Guam waters, February 2015.

Green turtles are known to nest on the Haputo ERA beach. The endangered hawksbill turtle is expected to occur in nearshore waters within the footprint of the proposed action, but nesting at the Haputo ERA has not been confirmed (see Section 4.1.8.1, Terrestrial Biological Resources).

The ESA-listed threatened scalloped hammerhead shark has only been documented in Guam's Outer Apra Harbor, which has been noted for neonate and juvenile aggregations. While scalloped hammerhead sharks may occur in the waters surrounding Guam, they are not anticipated to be prevalent outside Guam's Outer Apra Harbor.

The bumphead parrotfish has been observed in the nearshore waters of the Haputo ERA, mostly as juveniles or smaller females (SWCA 2009 [as cited in SWCA 2010]).

Marine Conservation Areas

The majority of the coral reef areas offshore of Finegayan are included in the Haputo ERA, which extends offshore on DON land to a depth of 121 feet (37 m). The Haputo ERA was established by the CNO on March 15, 1984, as one of several potential mitigation measures implemented by the DON to obtain approval from federal and GovGuam agencies for the construction of a munitions wharf (Kilo Wharf) at Adotgan Point in Outer Apra Harbor, Guam. This ERA is 252 acres (102 ha) in area and was established to protect two separate biological units, a terrestrial and marine unit. The marine unit, which includes the Double Reef area described above, provides six main macrohabitats supporting corals and a nursery for marine species of subsistence and commercial fishery value. The 72-acre (29-ha) marine unit originates at the mean lower low water line and extends to the edge of the outer coral reef line. Submerged lands are also discussed in Section 4.1.6.

The Haputo ERA General Management Plan (2010) states that 941 species of marine macrofauna have been recorded here, including 204 fish species, 154 coral species, and 757 other invertebrate species. Scleractinian coral species make up approximately 60% of the coral fauna with high diversity (163 species). These coral species are important in that they create the framework of the reef and are generally referred to as "reef-builders." Additional detailed information can be found in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.5.2: Finegayan, pages 11-48 to 11-49). Further information regarding Guam's submerged lands offshore can be found in Land and Submerged Land Use (Sections 3.6 and 4.1.6 of this SEIS).

4.1.9.2 Environmental Consequences

Construction

There are no anticipated direct impacts to marine resources as a result of the construction of the proposed cantonment/family housing at Finegayan. Potential indirect impacts on marine resources from this action are similar to those stated in the 2010 Final EIS, but of reduced intensity due to a smaller footprint with fewer people being relocated for the action proposed in this SEIS. More detailed information is available in the 2010 Final EIS, but is summarized below (Volume 2, Chapter 11: Marine Biological Resources, Section 11.2: Environmental Consequences, pages 11-78 to 11-80). Construction of facilities common to all alternatives (i.e., schools and off-site utilities) would have no impact on marine biological resources.

As described in Section 4.1.2, Water Resources, there are currently elevated levels of nutrients measured on the west coast of Guam. Discharge from the Northern District WWTP contributes to the current nutrient levels. The WWTP is out of compliance with the permit issued by USEPA in April 2013 and increasing the wastewater discharge from a non-compliant treatment plant would result in significant indirect impacts to marine flora and invertebrates, fish, and EFH during the period of non-compliance. To comply with permit condition requirements, the multi-port diffuser must be installed on the Northern District WWTP outfall and treatment upgrades must be completed. Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate the significant indirect impacts to nearshore waters (and therefore, marine flora and invertebrates, fish, and EFH in the vicinity of the WWTP outfall) once the upgrades are completed. Until the WWTP upgrades are completed (anticipated to be early in the operational phase of the proposed action) there would be an indirect and unmitigable significant impact to nearshore waters during construction.

Impacts to marine flora and invertebrates, fish, and EFH resulting from increased WWTP discharges are stated above, and they are not included in the analysis for each subcategory below, which is limited to stormwater, sedimentation, and other non-point source pollution and recreational impacts. The measures used to minimize these potential impacts, including appropriate resource agency specific BMPs, construction and industrial permit BMPs, LID features in accordance with the DoD UFC LID (UFC 3-210-10) and Section 438 of the EISA, USACE permit conditions, and general marine resources protective measures, are described in the 2010 Final EIS (Volume 7 and Volume 2, Chapter 11: Marine Biological Resources, Section 11.2: Environmental Consequences, pages 11-70 to 11-71) and summarized in Chapter 2 of this SEIS. Specifically, the site-specific SWPPP within the Construction General Permit would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flowrate of runoff and thereby minimize suspension of sediment and promote infiltration of runoff. The vegetative cover over this distance would provide additional buffer and protection from stormwater runoff or sediment reaching Haputo Bay.

Marine Flora and Invertebrates

There would be no direct impacts and less than significant indirect impacts on marine flora and invertebrates as a result of construction for the proposed action at Finegayan. These resources would not be modified from existing conditions considering the distance and elevation from the shoreline, the minimal runoff from the limestone landscape, and the implementation of protective measures to prevent stormwater runoff from reaching nearshore waters.

Contract construction personnel would be issued base passes for official business only and these restrictions would be specified in construction contracts. Use of Haputo ERA is therefore not expected to increase as a result of construction personnel.

The DON plans to educate construction workers via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities around Guam. Indirect short-term impacts to marine flora and invertebrates may still occur from increased nearshore activities in the area by construction workers.

With implementation of access restrictions and environmental education and outreach for the construction workforce, there would be no direct impacts and less than significant indirect short-term impacts to marine flora and invertebrates.

Fish

There would be no direct impacts and less than significant indirect impacts on fish as a result of construction for the proposed action. Contract construction personnel would be issued base passes for official business only and these restrictions would be specified in construction contracts. Use of Haputo ERA is therefore not expected to increase as a result of construction personnel.

The DON plans to educate construction workers via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities around Guam. Indirect short-term impacts to fish stock may still occur from increased fishing activities in the area by construction workers.

With implementation of access restrictions and environmental education and outreach for the construction workforce, there would be no direct impacts and less than significant indirect short-term impacts to fish.

Essential Fish Habitat

The construction of the cantonment/family housing at Finegayan would result in no direct impacts and less than significant indirect impacts to EFH for reasons consistent with those given above for marine flora and invertebrates. There would be no impacts to EFH from stormwater, sedimentation, or other non-point source pollution from construction projects due to compliance with the Construction General Permit and the implementation of appropriate construction BMPs.

Per the Magnuson-Stevens Fishery Conservation and Management Act, there would be no adverse effect on EFH because construction of the proposed action would not reduce the quality or quantity of EFH with implementation of access restrictions, environmental education and outreach for the construction workforce, and the Construction General Permit and appropriate construction BMPs.

Special-Status Species

There would be no direct impacts and less than significant indirect impacts on special-status species as a result of construction of the proposed action with implementation of the Construction General Permit, implementation of appropriate construction BMPs, and access limitations for construction workers, as described for the resources above.

To avoid and minimize any potential impacts to in-water sea turtles from proposed facility lighting associated with the construction of the cantonment/family housing area at Finegayan, hooded lights would be used to the maximum extent practicable at all new roads and facilities near coastline areas. Illumination of coastline areas would be kept to an absolute minimum. Therefore, there would be no impacts to sea turtles within the nearshore waters of the Haputo ERA with implementation of the proposed construction activities associated with Alternative A.

Marine Conservation Areas

With implementation of access restrictions for construction personnel, use of Haputo ERA is not expected to increase as a result of the construction workforce. Therefore, no direct or indirect impacts to marine conservation areas are expected.

Operation

Potential effects of proposed Finegayan cantonment/family housing operations are described in detail in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.2: Environmental Consequences, pages 11-80 to 11-84) and summarized for reference below. Potential operation impacts of the proposed Finegayan cantonment/family housing analyzed in this SEIS would be substantially lower compared to those evaluated in the 2010 Final EIS given that the proposed Marine Corps relocation has been scaled down. Operation of facilities common to all alternatives (i.e., schools and off-site utilities) would have no impact on marine biological resources.

Marine flora and invertebrates, fish, and EFH would be impacted by the increased wastewater discharge from the Northern District WWTP for treatment and disposal of generated wastewater during the operation of cantonment and family housing under Alternative A. The DON would gradually contribute additional flow to the Northern District WWTP as the population increased as a result of the Marines relocating to Guam. The added flow to the WWTP should be less than an 18% increase before 2020. The potential impacts would be similar to those described earlier in this section for construction-related impacts and would occur because the Northern District WWTP is non-compliant with the standards required by the current NPDES permit and increasing the wastewater discharge from a non-compliant treatment plant would be a significant indirect impact. However, upgrades to bring the Northern District

WWTP into compliance with the permit would mitigate the impact to a less than significant level. Northern District WWTP improvements would reduce biochemical oxygen demand and total suspended solids, may lower the levels of nutrients flowing out of the Northern District WWTP outfall, and would change the ammonia discharged from the WWTP to nitrate, which is a less toxic compound for marine species. It is expected that the treatment upgrades would be completed early in the operational phase of the proposed cantonment and family housing and nutrient levels would decrease in the environment adjacent to the Northern District WWTP.

Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate significant impacts to marine biological resources. The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. The water and wastewater assessment that DoD prepared to support the Implementation Plan recommended upgrades to the Northern District WWTP and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

Impacts to marine flora and invertebrates, fish, and EFH resulting from increased WWTP discharges are stated above, and they are not included in the analysis for each subcategory below, which is limited to stormwater, sedimentation, and other non-point source pollution and recreational impacts.

Marine Flora and Invertebrates

The operation of the cantonment/family housing at Finegayan would not directly impact marine flora and invertebrates. These resources would not be modified from existing conditions considering the distance and elevation from the shoreline, the minimal runoff from the limestone landscape, and the implementation of protective measures to prevent stormwater runoff from reaching nearshore waters.

The DON plans to educate its service members and their dependents via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities, particularly since the proposed cantonment/family housing are close to the ocean and nearby beaches, potentially leading to increased recreational use of marine biological resources in the immediate area. The Environmental Compliance Assessment, Training and Tracking System program is one possibility for such an educational training program to minimize these potential increased recreational impacts to marine flora and invertebrates. Additionally, restrictions on the use of Haputo Beach and the ERA would be included within the joint region INRMP to prevent disturbance of sensitive species in recreational areas.

Implementation and enforcement of appropriate BMPs (provided in Chapter 2) and protective measures would further avoid and minimize potential long-term, indirect impacts to marine flora and invertebrates from stormwater, sedimentation, and other non-point source pollution from operational activities. For example LID measures would include vegetated swales for conveyance and detention/retention ponds capable of capturing, storing, and treating additional runoff from the 25-year design storm. For each basin, water quality treatment strategies were selected based on the effectiveness of BMPs to treat identified pollutants of concern from proposed land uses within that basin. Implementation of LID

measures would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event.

With implementation of Haputo Beach and ERA access restrictions, environmental education and outreach for DON service members and their dependents, and operation and maintenance of LID measures and BMPs, there would be no direct impacts and less than significant indirect short-term impacts to marine flora and invertebrates.

Fish

There would be no direct impacts to fish as a result of the operation of the cantonment/family housing at Finegayan. Indirect impacts to fish stocks around the project area may occur from increased use of this resource by DoD personnel and their dependents living and working at Finegayan. The magnitude of impacts is directly related to the increase in recreational use.

Potential indirect impacts on local fish stocks as a result of the proposed increase in military population and dependents at Finegayan are expected to be less than significant, primarily because past studies have shown that military personnel do not play a large role in recreational fishing. Instead, military personnel tend to use charter services, which make up only 7% of the fleet. Local residents do most of the recreational fishing in the area, with tourists, military personnel, and residents associated with the military accounting for a smaller proportion of recreational fishing activity (Allen and Bartram 2008). Current levels of recreational fishing are well below the historic highs of the 1990s, there has been no evidence of overfishing in the waters around Finegayan, and the military relocation to Guam would not substantially contribute to any existing pressures on the resource.

The DON plans to educate its service members and their dependents via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities, particularly since the proposed cantonment/family housing are close to the ocean and nearby beaches, potentially leading to increased recreational use of marine biological resources in the immediate area. The Environmental Compliance Assessment, Training and Tracking System program is one possibility for such an educational training program to minimize these potential increased recreational impacts to fish. Additionally, restrictions on the use of Haputo Beach and the ERA would be included within the joint region INRMP to prevent disturbance of sensitive species in recreational areas.

Implementation and enforcement of appropriate BMPs (provided in Chapter 2) and protective measures would further avoid and minimize potential long-term, indirect impacts to fish from stormwater, sedimentation, and other non-point source pollution from operational activities. For example, LID measures would include vegetated swales for conveyance and detention/retention ponds capable of capturing, storing, and treating additional runoff from the 25-year design storm. For each basin, water quality treatment strategies were selected based on the effectiveness of BMPs to treat identified pollutants of concern from proposed land uses within that basin. Implementation of LID measures would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event.

With implementation of Haputo Beach and ERA access restrictions, environmental education and outreach for DON service members and their dependents, and operation and maintenance of LID measures and BMPs, there would be no direct impacts and less than significant indirect short-term impacts to fish.

Essential Fish Habitat

The operation of the cantonment/family housing at Finegayan would result in no direct impacts and less than significant indirect impacts to EFH for reasons consistent with those given above for marine flora and invertebrates. With implementation of Haputo Beach and ERA access restrictions, environmental education and outreach for DON service members and their dependents, and operation and maintenance of LID measures and BMPs, there would be no direct impacts and less than significant indirect short-term impacts to EFH as a result of stormwater, sedimentation, and other non-point source pollution and recreational impacts. Per the Magnuson-Stevens Fishery Conservation and Management Act, the DON has determined that during the interim period of change when the effluent discharged from the Northern District WWTP would not meet Guam Water Quality Standards, the proposed action may adversely affect EFH, but effects would be temporary and less than significant (see discussion above under Operation). In accordance with the Magnuson-Stevens Fishery Conservation and Management Act, the DON has requested consultation with NMFS about effects to EFH during the interim period.

Special-Status Species

There would be no direct impacts and less than significant indirect impacts on special-status species as a result of the operation of the cantonment/family housing at Finegayan. Impacts would be avoided and minimized through the implementation and management of appropriate BMPs and access limitations to military personnel and their dependents as described for the resources above. There would be no impacts on special-status species from stormwater, sedimentation, or other non-point source pollution from operational activities due to the implementation of appropriate LID and BMPs.

Conservation efforts implemented by the DON may provide additional protection to all coral, including those recently listed under the ESA, and sea turtles within the waters of the Haputo ERA and adjacent areas.

Increased dive boat operations have the potential for increased turtle harassment and strikes. However, because of the mobility of sea turtles combined with implementation of sea turtle specific BMPs, potential increased recreational activities would result in less than significant impacts to sea turtles. In addition, any such impacts to the sea turtle population would be reduced in intensity from the previously proposed action evaluated in the 2010 Final EIS and the proposed action assessed in this SEIS would continue to be in compliance with the 2010 NMFS BO.

Marine Conservation Areas

The operation of the proposed cantonment/family housing at Finegayan is expected to result in less than significant direct and indirect impacts to conservation efforts and management activities at the Haputo ERA.

Protective measures would minimize these impacts from anticipated increased use of popular dive sites at Haputo ERA outside of DoD control. Indirect impacts from recreational activities such as snorkeling, scuba diving, boating (anchoring, fishing, diving, snorkeling), and fishing practices (pole, gill/throw net, and spear fishing) would be avoided and minimized to less than significant through implementation of the existing JRM INRMP (JRM 2013). This includes restrictions on the use of Haputo Beach; marine biological resource education via environmental awareness training on ESA, MMPA, and EFH to military personnel and through public outreach; controlled access (a short video and access pass required before entry); informational documents (i.e., preparation of a Military Environmental Handbook); distribution of natural resource educational materials to dive boat operators; multiple designated mooring areas offshore; and increased efforts towards ERA enforcement.

4.1.10 Cultural Resources

4.1.10.1 Affected Environment

The following discussion summarizes previous cultural resources studies and known historic properties and other cultural resources within the area of potential cultural resource impacts associated with Alternative A. The discussion below addresses historic properties, as defined in the NHPA, and resources of cultural importance as defined under NEPA. The discussion refers to the terms *direct effects* and *indirect effects* to historic properties as defined under the NHPA, and impacts to other cultural resources as defined under NEPA (see Section 3.10.3.2). The section is organized to address cultural resources for the cantonment/family housing, followed by discussion of the same resource types for off-site utilities and school expansions associated with this alternative. If this alternative is selected for implementation, the information presented here would be augmented by reviews consistent with the 2011 PA, which provides overall NHPA Section 106 compliance and addresses other cultural resource issues. Refer to Section 3.10 for a detailed description of the 2011 PA. Additionally, some built properties in this section are covered by *Program Comments* executed by the ACHP, which resolve Section 106 responsibilities for certain DoD facilities. See Chapter 3, Section 3.10 for more information on definitions and procedures.

Located on the northwestern side of Guam, Finegayan is a telecommunications installation that was first established during the 1950s. The installation includes radio frequency systems and terrestrial-based fiber optic cables. Alternative A would construct and operate administrative and family housing areas, community support facilities (e.g., schools, child development center, community center), and associated utilities (see Figure 2.4-4 in Chapter 2 of this SEIS).

The affected environment for cultural resources associated with Alternative A is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 12: Cultural Resources, Section 12.1.2.2: Finegayan, pages 12-16 to 12-19), which were based on surveys of the PDIAs completed at that time. The description of the affected environment provided here has been updated with new information from recent archaeological and architectural investigations supporting other projects. To determine whether information is from an existing reference (such as the 2010 Final EIS or other cultural resource studies) or collected during in-fill studies conducted in support of this SEIS, refer to dates in the reference column in each table for the archaeological sites. Information for the architectural resources was derived from the internet Navy Facilities Asset Data Store (iNFADS).

Surveys conducted to support the 2010 Final EIS included the PDIA for Alternative A. Those previous investigations included intensive archaeological surveys (Athens 2009; Welch 2010), architectural inventories (Welch 2010), potential TCP studies (Griffin *et al.* 2010), and oral histories (Welch 2010). The previous investigations provide a comprehensive inventory of cultural resources occurring within the Alternative A PDIA.

In addition to the primary cantonment/family housing areas, on-site utility corridors associated with Alternative A would be located along the southern boundary of AAFB adjacent to Route 9 (see Figure 2.4-5). Intensive archaeological surveys of the proposed utility line impacted area on AAFB were conducted in 2004 (Yee *et al.* 2004), 2008 (Athens 2009) and 2010 (Dixon and Walker 2011).

All cantonment/housing alternatives would include construction of off-site utilities along Routes 1, 3, and 9, a water well field at AAFB, and expansion or construction of two schools at Naval Base Guam and AAFB (see Figure 2.4-14). Assessments of potential impacts to cultural resources from construction of utilities along road right-of-ways are based on a reconnaissance survey of portions of the area in 2010 (Dixon *et al.* 2011b) and a literature review of previous surveys and historic development in the area.

Assessments of impacts to cultural resources from the development of a water well field and from the two school expansions are based on in-fill surveys conducted in support of this SEIS (Dixon *et al.* 2014).

Based on data from previous surveys of the proposed cantonment/family housing area, and utility corridor impacted areas, Table 4.1.10-1 lists 19 known archaeological sites located within PDIA for Alternative A. Of the 19 sites, 11 are considered eligible for listing in the NRHP and include 7 Pre-Contact/Latte Period artifact/ceramic scatters, 1 Pre-Contact/Latte Period site with a midden and artifact scatter, 1 Pre-Contact/Latte Period habitation site, and 2 historic/First and Second American Territorial sites. Eight sites ineligible for listing are comprise of disturbed WWII encampments and Pre-Contact/Latte Period pottery scatters.

Table 4.1.10-1. Archaeological Sites within the Finegayan Cantonment/Family Housing Alternative PDIA

GHPI Number	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-1350***	1029	Water catchment structure	First American Territorial	Welch 2010	Yes	D
66-08-2293	NF1	Concrete foundations, concrete-curbed pit, artifact scatters	Post-WWII/Second American Territorial	Athens 2009	No	NA
66-08-2294	NF2	Concrete pads and slabs	Post-WWII/Second American Territorial	Athens 2009	No	NA
66-08-2295	1012	Artifact scatter	Pre-Contact/Latte	Athens 2009	No	NA
66-08-2296	1018	Artifact scatter	Pre-Contact/Latte	Athens 2009	No	NA
66-08-2297	1019	Artifact scatter	Pre-Contact/Latte	Athens 2009	No	NA
66-08-2298	1020	Artifact scatter	Pre-Contact/Latte	Athens 2009	No	NA
66-08-2299***	HAP-5/1021	Artifact scatter/concrete pad	Pre-Contact/Latte Post-WWII/Second American Territorial	Welch 2010	Yes	D
66-08-2300***	HAP-7/1023	Defensive structures	Post-WWII/Second American Territorial	Welch 2010	Yes	A, D
66-08-2301***	HAP-6/1022	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2302***	ANT-2/1025	Encampment	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-08-2303***	ANT-3/1026	Habitation site/artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2304***	ANT-5/1027	Encampment	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-08-2305	ANT-6/1028	Encampment	Post-WWII/Second American Territorial	Welch 2010	Yes	D
66-08-2306***	ANT-8/1030	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2307***	ANT-9/1033	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2308***	ANT-10/1034	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2309***	ANT-11/1035	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2701	T-1/378	Ceramic scatter	Pre-Contact/Latte	Haun 1988	Yes	D

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable. NRHP criterion D = eligible for potential to yield information important in prehistory or history.

Notes: *Map numbers are from Welch *et al.* (2009) and Welch (2010).
**Revised to match Guam GHPI forms dated May 28, 2014.
***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2, 2014 [RC2013-0853]).

Two NRHP-eligible archaeological sites, located on AAFB, have been identified within the PDIA for Alternative A on-site utility corridors (see Figure 2.4-5; Table 4.1.10-2). However, data recovery for both sites has been performed as mitigation for a previous project (Eakin *et al.* 2012).

Table 4.1.10-2. Archaeological Sites within the Finegayan Cantonment/Family Housing Alternative Onsite Utilities PDIA

GHPI Number	*Temporary Site Number/ Map Number*	*Site Type*	*Period*	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-2551***	T-W-4	Historic farmstead	Post-WWII/Second American Territorial	Dixon and Walker 2011	Yes*	D
66-08-2552***	T-W-7	Artifact scatter	Pre-Contact/Latte	Dixon and Walker 2011	Yes*	D

Legend: NRHP criterion D = eligible for potential to yield information important in prehistory or history.
Note: *Data recovery excavations were conducted at both sites (Eakin *et al.* 2012), which determined that neither site had an intact subsurface cultural deposit.
**Revised to match Guam GHPI forms dated May 28, 2014.
***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2, 2014 [RC2013-0853]).

No TCPs have been identified in the PDIA for this alternative; however, there is one potential TCP in the vicinity: Haputo (GHPI Number 66-08-0007) located approximately 1,640 feet (500 m) from the proposed family housing area.

There are 147 architectural properties, constructed between 1953 and 1994, within the PDIA for Alternative A (Table 4.1.10-3). These buildings and structures include barracks, administrative facilities, and recreational facilities. Thirty-seven buildings are bachelor housing covered under the *Program Comment for Cold War Era Unaccompanied Personnel Housing* (ACHP 2006; see Chapter 3.10.3 for more information on the Program Comments). Seventeen buildings are housing support facilities, including garages and other facilities covered under the *Program Comment for Wherry and Capehart Era Family Housing at Air Force and Navy Bases* (ACHP 2004). Three buildings and structures are support facilities (recreational and hydrologic facilities) that are greater than 50 years in age that have not been evaluated. Five wells and two buildings of unknown age have also not been evaluated for NRHP-eligibility. If Alternative A were selected, any unevaluated properties would be evaluated under the procedures identified in the 2011 PA. Eighty-three buildings have been determined ineligible for listing in the NRHP, including 24 buildings that are less than 50 years old and do not meet the exceptional significance threshold required under NRHP Criteria Consideration G. The 2011 PA includes procedures for the identification of historic properties, as specific projects are developed, through consultation with the Guam SHPO and the public.

Table 4.1.10-3. Summary of Architectural Properties Located within the Finegayan Cantonment/Family Housing Alternative PDIA

Building/Structure Type	*Location*	*Number of Buildings/ Structures of this Type in Potentially Impacted Area*	*Date of Construction*	*NRHP Eligible?*
Housing Facilities for Unaccompanied Personnel (barracks)	Finegayan	37	1954 to 1968	Covered under Program Comment
Ancillary Housing Facilities (garages)	Finegayan	13	1954 to 1962	Covered under Program Comment
Housing Support Facilities	Finegayan	4	1954 to 1955	Covered under Program Comment
Support Facilities				
Recreational Facilities	Finegayan	1	1963	Not Evaluated
Hydrologic Support Facilities	Finegayan	2	1954 to 1965	Not Evaluated
Wells	Finegayan	5	Unknown	Not Evaluated
Pavilions/Bus Stop/Shelters	Finegayan	33	1961 (n=1); Unknown (n=32)	No
Unknown	Finegayan	2	1968 (n=1); Unknown (n=1)	Not Evaluated
Administrative, utilities, recreation, training, and support facilities	Finegayan	26	1953 to 1965	No
Administrative, utilities, recreation, and support facilities	Finegayan	24	1966 to 1994	No

Note: Information on type, number, and date of construction from iNFADS.

Certain off-site utility improvements are common to all of the cantonment/family housing alternatives. In addition to the cantonment/family housing, and utility corridor areas, Alternative A would include construction of off-site utilities, a water well field, and expansion or construction of two schools. One site, T-H-1, is within the off-site utility corridor. This site is not eligible for listing in the NRHP. No architectural properties or TCPs have been identified within the off-site utilities PDIA.

Nine NRHP-eligible archaeological sites and 15 sites not considered eligible for listing in the NRHP have been identified within the water well field development area (Table 4.1.10-4). Of the 9 sites, 1 is a portion of NWF, 1 is a First American Territorial Period water catchment site, 2 are Latte Period artifact and ceramics scatters, and 5 are WWII artifact scatters. One of the NRHP-eligible sites contains human remains. Ten architectural properties have been identified within the water well field development area (Table 4.1.10-5). Of the 10 structures, 1 is considered eligible for listing in the NRHP, 6 are unevaluated, and 3 are not eligible.

Table 4.1.10-4. Archaeological Sites within AAFB Water Well Development PDIA Common to All Cantonment/Family Housing Alternatives

GHPI Number	*Temporary Number*	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-1065***		Airfield	Pre-Contact/ Latte, Post-WWII Second American Territorial	Aaron *et al.* 2007, Dixon *et al.* 2011b	Yes	D
66-08-1344***		Guerrero water catchment	First American Territorial	Schilz *et al.* 1996, Dixon *et al.* 2011b	Yes	A, C, D
	T-90-1	Artifact scatter	Post- WWII/ Second American Territorial	Dixon and Walker 2011	No	NA
	T-90-2***	Artifact scatter	Post- WWII/ Second American Territorial	Dixon and Walker 2011	Yes	D
	T-90-3***	Ceramic scatter	Post-WWII/ Second American Territorial	Dixon and Walker 2011	Yes	D
66-08-2727	T-MSAU-1	Japanese dump and ground stone tool	Pre-Contact/ Latte, WWII Japanese Military Occupation	Dixon *et al.* 2011b	No	NA
66-08-2703	T-WAW-001	Historic water well and concrete pad complex	Post- WWII/ Second American Territorial	Dixon *et al.* 2014	No	NA
	T-WAW-002	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-08-2705	T-WAW-004	Bottle scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
	T-WAW-006***	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2014	Yes	D
	T-WAW-007***	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2014	Yes	D
	T-WAW-008	Rock alignment/rock mound	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
	T-WAW-009	Rock alignment/ rock mound	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-08-2710	T-WAW-012	Rock alignment	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-08-2713	T-WAW-015	Ceramic scatter	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/ Latte/WWII Japanese Military Occupation/ Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA

Table 4.1.10-4. Archaeological Sites within AAFB Water Well Development PDIA Common to All Cantonment/Family Housing Alternatives

GHPI Number	*Temporary Number*	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
	T-WAW-025	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-08-2404***	T-U-4	Artifact scatter	Post-WWII/ Second American Territorial	Dixon and Walker 2011	Yes	D
66-08-2405	T-U-5	Japanese artifact scatter	WWII Japanese Military Occupation	Dixon and Walker 2011	No	NA
66-08-2406	T-U-6	Artifact scatter	Post-WWII/ Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2407	T-U-7	Artifact scatter	Post-WWII/ Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2408***	T-U-8	Artifact scatter	Post-WWII/ Second American Territorial	Dixon and Walker 2011	Yes	D
66-08-2410	T-U-10	Artifact scatter	Post-WWII/ Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2411	T-U-11	Artifact scatter	Post-WWII/ Second American Territorial	Dixon and Walker 2011	Yes	D

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable. NRHP criterion D = eligible for potential to yield information important in prehistory or history.

Notes: *Map numbers are from Welch *et al.* (2009) and Welch (2010).
**Revised to match Guam GHPI forms dated May 28, 2014.
***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

Table 4.1.10-5. Summary of Architectural Properties within the Water Well Development PDIA Common to All Cantonment/Family Housing Alternatives

Building/Structure Type	*Location*	*Number of Buildings/ Structures of this Type in Potential Impact Area*	*Date of Construction*	*NRHP Eligible?*
USGS Guam Geomagnetic Observatory Variations Building (Site Number 66-08-2724)	AAFB	1	Circa 1957	Yes
Water Pump Station (Facility 9038)	AAFB	1	1973	No
Pump houses (Facilities 9039 and 9050)	AAFB	2	2008 for Facility 9039; Unknown for Facility 9050	No
USGS Guam Geomagnetic Observatory Administrative Buildings	AAFB	4	Circa 1957	Not Evaluated
Unknown	AAFB	2	Unknown	Not Evaluated

The proposed Andersen Middle School expansion at AAFB and the DoDEA High School construction at the Naval Base Guam are common to Alternatives A, B, and D. Both of these areas were included in the intensive in-fill surveys conducted in support of this SEIS. No archaeological sites were recorded during the in-fill surveys in either area (Dixon *et al.* 2014). Three architectural properties are located within the Andersen Middle School expansion area, but all were built within the last 50 years and do not meet the exceptional significance threshold required under NRHP Criteria Consideration G (Table 4.1.10-6). No architectural properties are located at the DoDEA High School PDIA. No TCPs have been recorded in the Andersen Middle School or DoDEA High School PDIAs.

Table 4.1.10-6. Summary of Architectural Properties within the Andersen Middle School Expansion Impacted Area Common to Cantonment/Family Housing Alternatives A, B, and D

Building/Structure Type	*Location*	*Number of Buildings/ Structures of this Type in Potential Impact Area*	*Date of Construction*	*NRHP Eligible?*
Billboard	Andersen	1	2007	No
O/D Recreation Pavilion	Andersen	1	1992	No
Bus Stop	Andersen	1	Modern	No

4.1.10.2 Environmental Consequences

Construction

Construction activities associated with Alternative A may adversely affect historic properties. Final determinations of effect would occur following application of procedures outlined in the 2011 PA. Following is a discussion of potential adverse effects for purposes of this analysis. Excavation and soil removal associated with buildings and utilities construction could adversely affect 13 known NRHP-eligible archaeological sites, including Pre-Contact/Latte Period artifact scatters and other sites (see Tables 4.1.10-1 and 4.1.10-2). However, two of these sites (GHPI Numbers 66-08-2551 and 66-08-2552) have been previously mitigated via archaeological data recovery conducted in consultation with SHPO (Eakin *et al.* 2012).

Construction at Finegayan would also require the demolition of 24 buildings (Table 4.1.10-7). Of these 24 buildings in the PDIA, 16 are covered under the *Program Comment for Cold War Era Unaccompanied Personnel Housing* (ACHP 2006), 7 are not eligible, and 1 (facility number 209) is not evaluated. The Program Comment resolves NHPA Section 106 requirements for demolition of the 16 buildings. Under Alternative A, demolition of the 7 buildings that are not eligible for listing in the NRHP would be consistent with a no historic properties affected finding. Consistent with the 2011 PA, final determinations of eligibility, including the one unevaluated property, and assessment of effect would be completed in conjunction with project-specific reviews, if this alternative is selected.

Table 4.1.10-7. Architectural Properties to be Demolished within the Finegayan Cantonment Alternative PDIA

Building Name or Type	*Location*	*Facility Number(s)*	*Date of Construction*	*NRHP Eligible?*
Andersen Softball Field	Finegayan	159	1965	No
Public Quarters Junior Officer	Finegayan	173, 175, 185, 187, 188, 189, 191, 192, 193, 194, C190	1955	Covered under Program Comment
Public Quarters Enlisted	Finegayan	C202, C203, C204, C205	1963	Covered under Program Comment
Public Quarters - CO	Finegayan	197	1966	Covered under Program Comment
CDAA Building/Standby Generator 350 KW	Finegayan	200	1964	No
CDAA Building/Standby Generator 350 KW	Finegayan	204	1972	No
Swimming Pool Bathhouse	Finegayan	209	1963	Not Evaluated
NEX Storage Warehouse	Finegayan	305	1973	No
CDAA Chill Water Plant	Finegayan	335	1978	No
Bus Stop Shelter	Finegayan	387	Unknown	No
Swimming Pool Pavilion	Finegayan	498	1987	No
Billboard*	AAFB	1598	2007	No
O/D Recreation Pavilion*	AAFB	1660	1992	No
Bus Stop Shelter*	AAFB	80140	1993	No

Legend: KW = kilowatt
Note: *Facilities that would be demolished for the Andersen Middle School expansion.

Excavation and soil removal associated with the construction of off-site utilities and expansion of two schools could adversely affect 9 known NRHP-eligible archaeological sites (see Alternative A, Tables 4.1.10-4 and 4.1.10-5) and 1 NRHP-eligible structure. Six structures that are unevaluated could also be adversely affected by construction.

The Andersen Middle School expansion would require the demolition of three structures (see Table 4.1.10-7), which are not considered eligible for listing in the NRHP.

In addition, construction at Finegayan has the potential to directly impact culturally important resources that are not historic properties, but may be considered under NEPA. The project would require the removal of limestone forest where culturally important natural resources may be present. The 2011 PA contains measures for coordinating with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans regarding identification and disposition of these important resources (see 2010 Final EIS, Volume 2: page 2-10; Volume 9, Appendix G, Chapter 4).

Operation

Operations associated with Alternative A would not directly affect any historic properties or impact other resources of cultural importance. Indirect adverse effects to known NRHP-eligible archaeological sites on the coast could result from an increase in personnel and traffic in the area. The potential for indirect adverse effects to the Haputo site (GHPI Number 66-08-0007) could increase due to an anticipated general increase in use of recreational resources (see Section 4.1.7). The 2011 PA has a provision for Cultural Resources Awareness Training to reduce the risk of damage.

Summary of Impacts and Potential Mitigation Measures

Implementation of Alternative A could cause direct, adverse effects to 20 known NRHP-eligible sites and 1 NRHP-eligible structure, which is the largest number of effects compared to any of the other cantonment/family housing alternatives. Refer to Section 4.7, Table 4.7-1 for a comparison of cultural resources impacts and potential mitigation measures for each cantonment/family housing alternative. Two additional NRHP-eligible sites have been previously mitigated. There could be indirect adverse effects to one archaeological site/potential TCP at Haputo due to an increase in visitors and an increased potential for inadvertent or accidental damage. Demolition could also affect 7 buildings that have not yet been evaluated for listing in the NRHP (see Table 4.1.10-5 and 4.1.10-7). Direct impacts could occur to natural resources of cultural importance as a result of limestone forest removal. The 2011 PA includes measures to coordinate with SHPO and concurring parties to address appropriate treatment of these resources.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. Broadly, the 2011 PA includes processes to share information, consider views of the public, and develop mitigation measures when historic properties may be adversely affected. The 2011 PA provides measures for mitigating adverse effects to NRHP-eligible or listed archaeological sites, consulting on new projects and initiating additional identification efforts, and resolving impacts due to loss of access to culturally important natural resources. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided or minimized during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, Table 4.1.10-8 presents potential mitigation measures to resolve adverse effects to historic properties and reduce impacts to cultural resources from the implementation of Alternative A. With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that significant direct and indirect impacts due to construction and operations, as defined under NEPA, would be reduced to a level below significance.

Table 4.1.10-8. Potential Mitigation Measures for Alternative A for Adverse Effects (NHPA) and Impacts to Other Cultural Resources (NEPA)

NHPA Effects	***Mitigation***
Potential direct adverse effects to 21 historic properties—20 NRHP-eligible archaeological sites and 1 NRHP-eligible structure	Consistent with the 2011 PA, data recovery is the standard mitigation for historic property that is strictly archaeological in nature. Accordingly, the DON will submit a mitigation plan to the SHPO, consult with other PA Signatories and Concurring Parties if requested, and submit data recovery reports for SHPO review prior to finalizing mitigation reports. Mitigation also includes preparation of public education and interpretation materials in English and Chamorro using the information developed or data recovered to create a summary of the work completed and a statement regarding the mitigated site's significance to the regional culture. Additional mitigation could include enforcement of construction contract stipulations and GHPI data form updates as required by the 2011 PA.
Potential indirect adverse effects to one NRHP-eligible archaeological site/potential TCP	The DON will conduct initial orientation briefs for incoming DoD personnel to enhance Cultural Resources Awareness and strategically place educational signage to reduce the risk of inadvertent damage.
Undetermined effects to 7 unevaluated buildings	If this alternative is selected in the ROD, unevaluated properties that may be affected would be evaluated consistent with the 2011 PA. If determined eligible for listing in the NRHP, appropriate mitigation measures would be developed to resolve any adverse effects.

Table 4.1.10-8. Potential Mitigation Measures for Alternative A for Adverse Effects (NHPA) and Impacts to Other Cultural Resources (NEPA)

NEPA Impacts	*Mitigation*
Potential direct impacts to culturally important natural resources	Through the 2011 PA process, coordinate with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans to provide an opportunity to collect these resources consistent with installation security instructions and safety guidelines.

4.1.11 Visual Resources

4.1.11.1 Affected Environment

A list and description of visual resources at Finegayan is contained in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.1.1.2: Affected Environment, pages 13-9 to 13-13). The Finegayan area includes DON communication facilities surrounded by low grasslands, shrubs, and densely forested areas. Wide open vistas from, and into, this area are limited due to the terrain and vegetative canopy. Nevertheless, there are some areas with breaks in the canopy, providing panoramic vistas of natural and man-made features along Route 3.

4.1.11.2 Environmental Consequences

Construction

Because there is less development associated with the proposed action due to a reduced number of Marines and dependents being relocated, the degree of impact would be less than that described in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.2.2: Environmental Consequences, pages 13-65 to 13-67). Short-term direct impacts to existing public views would result from the presence of construction equipment, then would cease to continue after construction. Therefore, there would be less than significant impacts on visual resources.

Operation

The impacts would be less than significant on visual resources from operations. The impacts would be somewhat less than those impacts described in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.2.2: Environmental Consequences, pages 13-65 to 13-67), as there is less development proposed under this alternative. The proposed facilities would not be visible from recognized viewpoints, vistas, or overlooks.

The new base features would be designed to be consistent with the 2011 Installation Appearance Plan. While the base would not be accessible to the public, some features would be publicly visible including the entrance gates, perimeter fencing, peripheral landscaping, and vertical infrastructure (i.e., light posts and water tanks). These previously mentioned features as well as the remaining new base features would present a united design template, as outlined in the Installation Appearance Plan.

While some features would be publicly visible from roadways, no recognized view corridors or sensitive receptors would be impacted. In addition, the Haputo ERA Management Plan requires a no construction buffer zone of 100 feet (30.5 m) from the ERA boundary. Beyond the no-construction buffer zone, there would be a 200-foot (61-m) buffer zone where landscaping, fencing, and mowing would be allowed. There would also be an additional buffer of approximately 440 feet (134 m) from the cliffline to the Haputo Bay shoreline (total of 0.1 mile [0.2 km]). Therefore, less than significant direct long-term impacts on visual resources would result from implementation of this alternative.

4.1.12 Ground Transportation

4.1.12.1 Affected Environment

The affected environment for ground transportation resources associated with Alternative A includes transportation facilities internal to the site (on-base roadways and intersections) and entry control facilities. This section addresses existing conditions and assesses how the construction and operation of Alternative A would potentially affect transportation conditions for roadways, transit facilities, and pedestrian and bicycle facilities on-base. Potential ground transportation impacts to off-base (external) roadways are addressed in Section 6.1 of this SEIS.

Roadway Network

Finegayan is currently accessible via the existing gate located on Route 3 near Bullard Avenue. Currently, all of the on-base roadways are two lanes (one lane in each direction). Traffic counts at this military access point were conducted in December 2012. Based on the relatively low traffic demand observed at this location, the internal roadways and intersections are expected to operate at acceptable LOS (LOS A, B, C, D, or E) during the weekday a.m. and weekday p.m. peak hours.

Transit Network

There is no existing transit service on Finegayan. The GRTA operates fixed route and paratransit service. The Blueline 1, servicing Hagåtña, Tamuning, Micronesia Mall, and Tumon, is the nearest fixed route bus line, a distance of approximately 5.6 miles (9.0 km) from Finegayan. Paratransit service is provided to all Americans with Disabilities Act (ADA)-eligible certified passengers. Paratransit service provides transportation to the nearest fixed route.

Pedestrian and Bicycle Network

There are no dedicated pedestrian or bicycle facilities on or near Finegayan. However, shoulders exist along Route 1 and on Route 3, south of Route 28. Typically, the outside lane or shoulder, which is generally unpaved, functions as the pedestrian/bicycle space.

4.1.12.2 Environmental Consequences

Potential ground transportation impacts addressed in this section are limited to elements of the proposed action that could affect on-base (internal) roadways. Potential ground transportation impacts to off-base (external) roadways are addressed in Section 6.1 of this SEIS.

Construction

Construction of the new cantonment/family housing area, associated support facilities and roads associated with Alternative A would include clearing and grubbing, demolition of existing road pavement, excavation, filling, and landscaping. During the construction period, short-term, intermittent transportation impacts may result from truck movements as well as construction worker vehicles traveling within the site. Potential temporary and intermittent construction direct impacts generated by the proposed action at Finegayan would include impacts associated with the delivery of construction materials and equipment, removal of construction debris, and parking for construction workers.

Due to a combination of high demand for off-island construction workers, frequent truck trips for deliveries of construction materials, and the arrival of some of the relocating Marine Corps personnel and their dependents prior to completion of construction, 2021 is expected to be the peak year for construction-related traffic. Table 4.1.12-1 presents a summary of the estimated vehicle traffic during peak construction.

Table 4.1.12-1. Estimate of Year 2021 Peak Construction-Related Traffic

Destination	*Annual Trips by Origin*	
	Port	*Quarries*
Cantonment	81,972	347,154
Family Housing	14,894	59,942
Training Area	11,954	58,314
Apra Harbor	9,732	39,170
Total	**118,552**	**504,580**

Note: Construction-related traffic is assigned a passenger-car equivalency of 3.0 to account for the size and acceleration of construction vehicles relative to passenger vehicles.
Source: FHWA 2013.

The short-term construction-related traffic would result in congestion to on-base roadways because of the slower movements and larger turning radii of trucks compared to passenger vehicles. Tractor-Trailers, Dump Trucks, Concrete Trucks, Delivery Trucks, and Vans are assigned a passenger-car equivalency of 3.0 to account for their size and acceleration relative to passenger vehicles. Truck traffic that occurs during the peak commute hours, and peak hours of adjacent roadways (typically 7:00 a.m. to 9:00 a.m., and 4:00 p.m. to 6:00 p.m.) could result in worse LOS and higher delays at some intersections. However, the majority of truck traffic would be expected to occur during off-peak hours.

Construction workers and construction-related vehicle trips would have different trip origins and destinations compared to the Marine Corps personnel and their dependents. Consequently, short-term and intermittent impacts may occur during construction in locations that would not be impacted after construction, when the development is fully operational. Potential direct and indirect impacts to ground transportation resources from construction would be minimized with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, construction of Alternative A would have less than significant direct and indirect short-term impacts to on-base (internal) roadways.

Operation

Roadway Network

As currently proposed, Alternative A would be directly accessible from Route 3 and Route 3A. The existing gate would be closed, removed, and replaced. The cantonment area would be located at the north end of the site and would be accessible via a new Main Gate. The new Main Gate would be aligned with the westbound approach of the second roadway south of Potts Junction (i.e., the roadway immediately south of the access road to the Starts Golf Resort). At the north end of the site, a new Tactical Vehicle Gate (unattended) would be constructed on Route 3A. The family housing area would be located at the south end of the site and would be accessible via a new Residential/Commercial Gate. The new Residential/Commercial Gate would be aligned with an existing roadway, which would become the eastbound approach at the intersection with Route 3.

The proposed on-base (internal) roadway network hierarchy for Alternative A was determined based on the conceptual development plan and layout of the cantonment/family housing area and the capacity required to accommodate the expected travel demand on the facilities. The proposed on-base (internal) roadway network hierarchy diagram for Alternative A is included in an Appendix F of this SEIS.

An internal, four-lane arterial roadway would connect the cantonment with the family housing area. This roadway would provide the primary north/south connection between the cantonment and the family housing area. A second four-lane arterial roadway would extend from the proposed new Main Gate to the Marine Expeditionary Brigade Headquarters. These roadways would carry the heaviest traffic volumes,

including civilian employee trips from off-base to/from work locations, as well as trips by military personnel to/from off-base locations.

Under any of the proposed cantonment/family housing alternatives, construction of new on-base (internal) roadway facilities and entry control facilities would be required. The proposed action includes construction of on-base (internal) roadway and entry control facilities that would be implemented by the DoD. On-base (internal) roadway and entry control facilities for Alternative A, include, but are not limited to, the following:

- The existing gate would be closed and a new Main Gate would be constructed. The new Main Gate would form the fourth leg (westbound approach) of the existing Route 3/Chalan Kareta intersection.
- A new Commercial/Tactical Vehicle Gate would be constructed at the north end of the cantonment, on Route 3A.
- An internal four lane arterial roadway would connect the family housing area, in the south, to the cantonment, in the north.

All on-base (internal) roadway facilities have been designed with the capacity required to accommodate the expected travel demand. Specifically, on-base (internal) roadway segments and intersections are designed to operate at acceptable LOS (LOS A, B, C, D, or E) under future year (Year 2030) conditions with the proposed action. The proposed action would not result in a direct long-term significant impact to on-base (internal) roadways or intersections because the proposed action would not:

- Cause a roadway segment or intersection operating at acceptable LOS (LOS A, B, C, D, or E) to degrade to unacceptable LOS F.
- Add 5% or more to the total directional peak hour volume on roadway segments (measured in passenger car equivalents) and result in unacceptable LOS F.
- Add 50 or more peak hour trips (measured in passenger car equivalents) and result in unacceptable LOS F at intersections.

Entry Control Facilities

Mandatory vehicle access control to military installations is a DoD requirement (DoD Directives 5200.8 and 5200.8-R). Generally, the purpose of an Entry Control Facility (ECF) is to provide security by monitoring traffic entering a military installation. The degree of security required depends on the sensitivity level of the mission and the level of force protection at any given time. The level of identification and inspection requirements at an ECF would vary depending on the FPCON level.

The FPCON has a major effect on the processing time per vehicle and the resulting vehicle queues that may develop, due to changes in the inspection procedures under each FPCON level and the number of vehicles authorized for entry. For shorter time durations, the ECF should be designed to support operations at FPCON levels Charlie and Delta. At FPCON levels Charlie and Delta, traffic congestion is expected and may be relieved by authorizing entry to mission-essential personnel only. During periods of heightened security, such as FPCON Delta, complete vehicle inspection and personal identification are required. Processing rates range from 20 to 120 vehicles per hour per lane. However, the reduction in workforce to mission essential personnel only and the prohibition of entry to visitors during these conditions help to offset the reduction in vehicle processing capacity at the ECF.

In accordance with DoD 0-2000.12-H, *DoD Antiterrorism Handbook*, (February 2004), "the security measures of FPCON Bravo+ must be capable of being maintained indefinitely without causing undue

hardship, affecting operational capability, or aggravating relations with local authorities." Therefore, an ECF must be capable of supporting the security measures employed during FPCON Bravo+, including any Random Antiterrorism Measures employed in accordance with the installation Antiterrorism Program. Typical processing characteristics at FPCON Bravo+ include the identification (ID) of all vehicles, all vehicle occupants, and random vehicle inspection. Random Antiterrorism Measures can include, but are not limited to, erection of barriers and obstacles to control traffic flow; vehicle, cargo, and personnel searches; and variations in security routines.

The operations of the proposed ECFs are controlled, or dictated, by the traffic demand and the vehicle processing speed at the security check point. A quantitative analysis was conducted to evaluate the potential for queuing at the proposed ECFs. The methodology and capacity assumptions utilized for this analysis are based on information included in the Military Surface Deployment and Distribution Command - Transportation Engineering Agency (SDDCTEA) *Traffic and Safety Engineering for Better Entry Control Facilities* (2009) and the UFC 4-022-01 *Security Engineering: Entry Control Facilities/Access Control Points* (May 2005).

SDDCTEA documents the results of assessments at over 200 ECFs concerning security, safety, and capacity traffic engineering and has used this data to establish criteria regarding capacity and processing rates at ECFs. The manual processing rate per lane with one ID checker ranges from 300 to 450 vehicles per hour at FPCON Bravo+. With the implementation of tandem lane check arrangements, the manual processing rate per lane increases to a range of 400 to 600 vehicles per hour. For purposes of this analysis, it was assumed that each ECF would have two inspection lanes with one ID checker per lane. The manual processing rate per lane was assumed to be 300 vehicles per hour, or the low-range of the estimated processing rates with one ID checker. Therefore, with two processing lanes, approximately 600 vehicles per hour could be processed at each ECF at FPCON Bravo+.

Transit Conditions

The proposed action would not result in a direct long-term significant impact to transit, because the proposed action would not:

- Substantially increase traffic hazards to transit due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with applicable design standards.
- Fundamentally conflict with adopted policies, plans, or programs regarding public transit, or otherwise decrease the performance or safety of transit facilities.

Pedestrian and Bicycle Conditions

Bicycle and pedestrian facilities would be included in the construction of new on-base (internal) roadway facilities. Bicycle and pedestrian paths and facilities are integrated into the on-base transportation network as a means to improve mobility and safety of non-motorized traffic. The proposed bicycle and pedestrian network diagram for Alternative A is provided in Appendix F of this SEIS.

The proposed pedestrian and bicycle plan for Finegayan includes an extensive multi-purpose trail network along most major roadways throughout the cantonment. This network would provide access to most facilities within the cantonment and would provide a connection to the family housing area. All residential streets within the family housing area would be constructed with sidewalks on both sides of the street. A jogging/biking trail would circumnavigate the family housing area, connect to the cantonment, and continue around the periphery of the cantonment development.

The proposed action would not result in a significant direct long-term impact to pedestrians or bicycles, because the proposed action would not:

- Substantially increase traffic hazards to pedestrians or bicycles due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with applicable design standards.
- Fundamentally conflict with adopted policies, plans, or programs regarding bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

4.1.13 Marine Transportation

4.1.13.1 Affected Environment

The information and analysis here apply for each cantonment/family housing alternative and facilities common to all cantonment/family housing alternatives being considered in this SEIS. The level of use of marine transportation facilities is predicted to be the same regardless of the selected alternative.

The harbor is the main port of Guam and contains Naval Base Guam, Coast Guard Sector Guam, and José D. Leon Guerrero Commercial Port. A description of Apra Harbor, including the condition of facilities, levels of use, and associated shipping lanes, is contained in the 2010 Final EIS (Volume 2, Chapter 14: Marine Transport, Section 14.1.4: Apra Harbor, pages 14-1 to 14-9). The following information supplements the description of Apra Harbor's facilities and activities.

Updates to Facilities

The José D. Leon Guerrero Commercial Port (Port of Guam) has remained largely unchanged since it was constructed in the 1960s. Expansion of the Port of Guam's facilities and equipment upgrades has been proposed by PAG to improve operational efficiencies and increase the Port of Guam's capacity. The proposed military relocation created an additional impetus to implement studies and improvements to service the anticipated construction work and additional population. In August 2007, work began on updates to the Port of Guam's master plan, but no significant revisions have been completed to date (White 2013). Significant upgrades to the port are underway (the largest of which is a $50 million port improvement project started in February 2013 that will add 10 acres [4.05 ha] to the container and break bulk yards, and reconfigure the port and the entrance gate for more rapid, efficient and secure freight movements). The change to annual capacity and overall port processing times (total and specific vessel type) is not known.

Needs assessments for the proposed military relocation to Guam were based on preliminary information about cargo volumes and personnel relocation provided by JGPO. A final draft Port of Guam master plan was completed in April 2008 that set a schedule for upgrading the facilities. The master plan for the Port of Guam calls for nearly $200 million in capital improvement upgrades to Port of Guam facilities to support the military relocation. The modernization program was granted conditional approval from the Guam Legislature in December 2008, and would address both Guam's expected growth without the proposed action and the anticipated increase in cargo volume resulting from the proposed action.

Modernization of the Port of Guam is divided into three phases, Phase IA, IB, and II. The phases are summarized in the 2010 Final EIS (Volume 2, Chapter 14: Marine Transport, Section 14.1.4.1: Harbor, page 14-4), and detailed in an email from A. Rosenthal, Project Manager for PB America, on April 14, 2010. To date, Phase IA has progressed as follows:

- An amendment to the 2010 Defense Appropriations Bill transferred $50M of DoD FY 2010 funds to the U.S. Department of Transportation to fund Phase IA (Saipan Tribune 2010).

- USDA awarded the PAG $54.5 million in loans in October 2010 for the Modernization Program (Torres 2012).
- After the 2011 announcement by DoD that the military relocation would be adjusted downwards, the Port Modernization was adjusted to reflect needs of local communities (Torres 2012).
- Projects underway as of 2012 (Torres 2012) include a lighting upgrade for the Container Yard, replacement and repair of sheet piles in Gregorio D. Perez Marina, repair of columns of Foxtrot 5 Wharf, and the purchase of new cranes.
- The scope for a $4 million upgrade of Port security is being finalized.
- No work has begun on the Phase IB or Phase II modernization plan.

Updates to Level of Use

The PAG tracks information on vessels and their cargo. A summary of recent total vessel visits is shown on Table 4.1.13-1. Vessel tallies are presented for the following categories: Container Ship, Break-bulk/roll-on-roll-off/Bulk, Barges, Fishing, and Total. Break-bulk is cargo that is packed in cases, bales, cartons, drums, carboys, etc. Roll-on-roll-off is wheeled cargo that can be driven on/off the vessel (e.g., automobiles). Bulk is general cargo. The overall number of vessels calling on the Port of Guam steadily and substantially decreased between FY 1995 (2,924 vessels) and FY 2012 (635 vessels) (PAG 2008a, 2008b, 2013a), resulting in a decrease between those years of about 78% (2,289 vessels). The numbers of barges and fishing vessels have shown the greatest amount of decrease. The number of barges decreased from 169 (FY 1995) to 13 (FY 2012) while fishing vessels decreased from 2,161 (FY 1995) to 267 (FY 2012) (PAG 2008a, 2008b, 2013a). The decrease in vessel visits to PAG reflects the recent slowdown in the global economy. Improvement in the global economy may result in an increase in vessel visits. The decrease in fishing vessels is due to shifting fishing grounds and regulations (PAG 2013b), and is unlikely to return to former levels.

Table 4.1.13-1. Port of Guam Vessel Visits FY 1995 through FY 2012

Fiscal Year	*Container Ship*	*Break-bulk/Roll-on-Roll-Off/Bulk*	*Barges*	*Fishing*	*Total*
FY 1995	117	477	169	2,161	2,924
FY 1996	124	296	138	2,351	2,909
FY 1997	130	212	167	2,205	2,752
FY 1998	151	365	106	2,107	2,765
FY 1999	146	296	155	1,942	2,569
FY 2000	114	418	112	1,906	2,529
FY 2001	111	422	111	1,960	2,697
FY 2002	105	412	102	1,481	2,139
FY 2003	103	433	94	1,332	1,983
FY 2004	109	377	97	1,044	1,648
FY 2005	103	305	60	800	1,327
FY 2006	109	316	17	771	1,289
FY 2007	153	165	21	651	1,113
FY 2008	165	171	17	586	1,022
FY 2009	161	192	21	499	989
FY 2010	395	102	41	128	793
FY 2011	149	122	9	343	789
FY 2012	94	136	13	267	635

Sources: PAG 2008a, 2008b, 2013a.

The number of container ships and the number of containers handled by the Port of Guam remained relatively constant during the period of FY 1995 through FY 2006, with an average of 119 ships and 84,356 containers annually. The annual number of ships and total containers handled increased substantially during the period between FY 2007 and FY 2011 (with an average of 205 and 97,326, respectively), before falling to previous levels in FY 2012 (94 and 85,464, respectively) (PAG 2013a).

4.1.13.2 Environmental Consequences

The short-term construction and long-term use of the cantonment/family housing, as well as associated training facilities, and support activity and construction, may directly affect marine transportation by impacting the military, commercial, and recreational navigational usage of Apra Harbor through the increased number of vessels. It is critical that navigational access to the harbor facilities and channels be maintained for all users. Apra Harbor is the only DoD harbor that could accommodate the vessels required for the relocation of the Marines to Guam. As no other locations can feasibly accommodate the Marines, no other alternative location will be considered.

Marine Transport to Support Cantonment/Family Housing

The marine transport analysis in the 2010 Final EIS (Volume 2, Chapter 14: Marine Transport, Section 14.1.4: Apra Harbor, pages 14-1 to 14-9) determined a less than significant impact from additional vessel transit required for the construction and occupation of the cantonment/family housing. It was estimated that an additional 242 break-bulk vessels and 145 container vessels would be required annually. This number of additional annual vessel visits was assumed for both construction and operation of cantonment/family housing.

Since the issuance of the 2010 Final EIS, the size of the proposed permanently relocated force has been reduced from a force of approximately 8,600 Marines with 9,000 dependents to a force of approximately 5,000 Marines with approximately 1,300 dependents (about 36% of the original size), which would reduce the magnitude of the expected increase in marine traffic due to the relocation. The relocation would also be more gradual and reach steady-state conditions at a later date. These revised characteristics, would further reduce the impact, with fewer overall expected vessel trips occurring at a later date.

The following analysis supersedes the analysis used in the 2010 Final EIS, due to the reduced size and altered timetable of the proposed action. The analysis presented here is a summary of relevant data from a future use study, as part of Apra Harbor's 2013 Master Plan (PAG 2013b).

A background increase in all types of cargo processed in Apra Harbor is predicted (1.1% annual increase until FY 2019, and a 0.9% annual increase thereafter). Table 4.1.13-2 summarizes predicted levels of cargo to be processed in Apra Harbor, under both background levels and with the proposed action.

Table 4.1.13-2. Forecast Port of Guam Cargo Processed

Fiscal Year	*Containers (Number/TEU)**	*Break-bulk/Roll-on-Roll-Off/Bulk (tons)*	*Liquid (million barrels)*
FY 2013	94,118 / 160,000	170,000	6.96
FY 2033 (Background)	114,118 / 194,000	205,000	8.42
FY 2033 (Alternative A)	128,823 / 219,000	216,000	8.91
Increase due to Alternative A in FY 2033	14,705 / 25,000	11,000	0.49
Peak level during Alternative A Construction (Year)	155,822 / 265,000 (FY 2022)	251,000 (FY 2021)	10.03 (FY 2021)

Legend: TEU = twenty-foot equivalent.
Notes: *Assuming 1.7 TEUs to Container.
Source: PAG 2013b.

A berthing-use analysis predicted a background berth utilization of 33% by FY 2033, with lower levels of utilization in earlier years. The proposed action would increase berth utilization to 43% in the peak year of construction (FY 2022), with lower levels of utilization during all other years in the range of analysis (2013-2033) (PAG 2013b). Analyses for crane and storage capacity over the same period similarly showed that while the proposed action would increase use, it is within the capacity of current facilities, and will not limit berth capacity (PAG 2013b). Because estimated berth utilization is well below capacity, short-term and long-term impacts would be less than significant.

4.1.14 Utilities

4.1.14.1 Affected Environment

This section includes information related to existing electrical, potable water, wastewater, solid waste, and IT/COMM utilities as they apply to Alternative A and facilities common to all alternatives.

Electrical Power

Electrical distribution for Alternative A includes the existing federally owned power distribution system. The power being supplied to this area comes from the GPA generation system via a 34.5 kV transmission line (owned by the DoD and leased to the GPA). The situation and condition of these utility systems is unchanged from the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1: Affected Environment, pages 3-5).

Potable Water

Existing facilities at Finegayan are served solely by the DoD water system. Alternative A includes existing water wells and a water distribution system that are owned, operated, and maintained by the DoD. The local water supply is primarily provided by on-site groundwater wells, with backup interconnection to the general DoD potable water system. Two existing elevated 250,000 gallon (946,353 liter) water storage tanks located along Route 3 in Finegayan and South Finegayan will be replaced with a new 500,000 gallon (1,892,706 liter) concrete cylindrical ground-level water storage tank. The new ground-level tank will be installed adjacent to the existing 200,000 gallon (757,082 liter) concrete ground-level storage tank (B144), with an updated supervisory control and data system and connection to the Harmon Pump Station. Both elevated storage tanks at Finegayan and South Finegayan are planned to be demolished. Changes to these existing storage tanks are not part of the proposed action.

The current distribution system is over 20 years old and consists of cast iron or asbestos cement pipe. There is also an existing 200,000-gallon (757,082-liter) ground-level water storage tank and water softening plant located near Route 3. This facility is connected to the DoD water system and would remain in service.

The DoD water transmission system in northern Guam consists of 10-inch and 12-inch asbestos cement and cast iron pipes, and is part of the DoD potable water system that conveys water between southern Guam and northern Guam. The main water sources for Finegayan are the wells located at Finegayan. The DoD is committed to improving its water loss control program, and has begun implementing measures to reduce unaccounted for water, as well as developing plans for further improvements. The FY 2013 unaccounted for water rate is 22% for the portion of the system which currently supplies Finegayan (NAVFAC Public Works Department, personal communication, September 2013). Water leak detection and repairs will continue for the system for further reduction of unaccounted for water. Tracking of unaccounted for water due to unbilled authorized consumption (e.g., water for firefighting, flushing) and water metering audits are also in process for proper accounting of water usage. The current DON goal for

unaccounted for water is to reduce water loss to 12% (NAVFAC Public Works Department, personal communication, September 2013).

The system serving the southern and central Guam DoD installations is supplied primarily from the DON Fena Water Treatment Plant. Recently, there has been concern as to whether water from this system exceeds drinking water standards for disinfection byproducts. The DON has implemented short-term measures to reduce disinfection byproducts. It continues to pursue long-term solutions and coordinates with the GWA in order to jointly address this issue. Alternative A for the cantonment/family housing would not typically be served by water from the southern DoD system.

While some GWA potable water system and management capabilities have improved since the 2010 Final EIS, the existing GWA potable water system still needs many improvements to bring the system up to standards. The GWA is currently under a court-issued stipulated order to improve their water systems and management. From April 23, 2012 to May 4, 2012, USEPA's NEIC conducted inspections of GWA's public potable water system and issued a report listing the inspection results (USEPA 2012). Deficiencies were found for GWA's wells, water sources, distribution system, and storage tanks, as well as issues with management and operations. Well deficiencies included potential sources of contamination near wells, leaking pipes and valves, insufficient well pads, improper chlorination and disinfection equipment, and more groundwater per well being withdrawn than GEPA permits authorize. The report found that GWA's water sources lack adequate backup pumps and meters, have leaking pumps, and gaps between roof and well walls allow entry by animals, birds, and reptiles. Deficiencies for the distribution system include lack of understanding of the whole system by the operators, undersized water lines, lack of standard operating procedures (SOPs), incomplete GIS maps, absence of a regular flushing program, an estimated unaccounted for water of approximately 50%, and frequent water outages. The report also indicated that GWA's water tanks are missing functioning control systems, and they are improperly managed, causing corrosion throughout the facilities.

The current GWA water system reportedly produces an approximate total of 42 MGd (159 MLd). GWA has made recent system improvements through leak detection and repairs and has reported a reduction in unaccounted for water to approximately 36% (GWA 2013). Thus, it seems GWA is making progress at reducing unaccounted for water from the prior estimates of 50%. GWA reports substantial progress towards achieving overall compliance with USEPA requirements. Notable improvements include the following:

Completing 53 out of 54 projects by deadlines set in the 2011 Court Order.

- Establishing a water meter replacement program and completing installation of over 25,000 new meters (GWA 2013).
- Completing a 15-month leak detection and repair project (GWA 2013).
- Publishing the Potable Water Production Enhancement Plan, on June 10, 2010 (GWA 2010).
- Publishing the Water Audit Program & Water Loss Control Plan, approved by the Consolidated Commission on Utilities, on August 23, 2011 (GWA 2011).

The current non-revenue water rate, according to the *GWA General Manager's Report* (GWA 2012), is 36% and uses the American Water Works Association M36 standard method of calculation. That compares favorably with prior estimates of 50%. Whether this is from actual improvements or reflects the difficulty in calculating unaccounted for water is not known.

GWA's Potable Water Production Enhancement Plan includes measures to increase production as well as reduce its loss rate (GWA 2010). This includes plans for capital improvement projects to rehabilitate existing deep wells, develop new wells, upgrade the Ugum Water Treatment Plant system, increase the Santa Rita Springs and Asan Springs production, repair or replace storage tanks, install master meters, and implement supervisory control and data acquisition at major GWA facilities and pressure zones. The GWA reports installing Residual Chlorine Monitors for both "high risk wells" and "medium risk wells," while design services for "low risk wells" is ongoing. The GWA is in the process of developing three new wells (AG-10, Site 8, Site 10) for increased water supply. The Santa Rita Springs was recently repaired in late 2012. Under the Capital Improvement Plan, the GWA would repair or replace 29 existing storage tanks by 2021. Construction of the GWA's first 2 million gallon (7.5 million liters) prestressed concrete tank was completed in August 2013 for Barrigada residents. Major repairs of Yigo #1 and Mangilao #2 are scheduled to be completed by the end of 2013. Installation of over 25,000 new Badger Meters has shown a substantial increase in water revenues; over $100,000 per month from January to June 2013.

Wastewater

The GWA compliance background contained in the 2010 Final EIS (Volume 6, Chapter 3: Wastewater, Section 3.1.3.2: Affected Environment, pages 3-19 to 3-25) is summarized below and is supplemented with new information. The wastewater infrastructure owned, maintained, and operated by the GWA has had a legacy of deferred maintenance and minimal capital improvements, which has caused the systems to deteriorate over the years. Lack of funding severely limited the GWA's ability to adequately maintain and improve the wastewater systems. Other factors contributing to the current condition of the GWA wastewater system include the tropical climate, typhoons, earthquakes, inflow and infiltration, increased population and aging infrastructure.

Condition assessments for GWA's wastewater collection system including pump stations and manholes were conducted as part of the 2006 GWA Water Resources Management Plan. The following are the general findings and recommendations from the 2006 GWA Water Resources Management Plan:

- Wastewater pump stations: Pumping equipment was found to be in overall better physical and functional condition as compared to the equipment at the larger wastewater treatment plants. Eighteen pump stations did not have emergency generators. Overall the pump stations that had emergency generators were in poor functional condition. The recommendation for pump stations improvements included upgrading both the electrical and Supervisory Control and Data Acquisition (SCADA) system.
- Manholes: Due to the size of the GWA system, the total number of manholes inspected was limited to 303 to focus on key locations with higher likelihood of problems along the larger diameter (i.e. greater than 10") portion of the collection system. In general, the manholes were in good structural condition and sulfide related corrosion was not identified as an issue. The most commonly identified issues in the collection system included grease, silt and debris, and evidence of collection system surcharging. Collection system surcharging was generally due to one or more of the following conditions: high inflow and infiltration due to wet weather, debris or grease buildup, poor gravity collection system hydraulics, or pump station operation and limitations/failures.

The current major wastewater compliance requirements for the GWA are covered under a 2011 court order, significant findings for wastewater from a USEPA NEIC inspection conducted in 2012, and 2013 NPDES permits requiring treatment upgrades for the Northern District WWTP and Agaña WWTP.

In November 2011, an *Order for Preliminary Relief RE: Deadlines for Outstanding Projects under the Amended Stipulated Order* (2011 Court Order) was entered into court. The effect of the 2011 Court Order terminated the 2006 amended stipulated order as described in the 2010 Final EIS. However, it did not resolve any claims for stipulated penalties for violations of the 2006 amended stipulated order prior to its termination. As preliminary relief, the 2011 Court Order included compliance requirements and deadlines for wastewater projects. The wastewater projects and compliance requirements outlined in the 2011 Court Order included interim primary treatment upgrades to the Northern District and Agaña WWTPs, interim effluent limits at the Northern District WWTP, infiltration/inflow analyses and sewer system evaluation surveys and complete upgrades to the Agat-Santa Rita, Baza Gardens, and Umatac-Merizo WWTPs. The 2011 Court Order also established requirements and programs for regular sewer cleaning, inspection, and initiation of new efforts to connect residents to the GWA sewer system.

In 2012, the USEPA's NEIC performed an inspection of the GWA's wastewater collection and treatment systems. The purpose of this inspection was to evaluate the management, operations, and maintenance of the wastewater collection systems and the NDPES-permitted WWTPs. The following is a summary of the significant findings by USEPA from the inspection:

- The GWA's sewage pump stations are subject to frequent power and equipment failures resulting in sewage spills.
- The GWA's aged and deteriorated sewer pipes are subject to excessive infiltration and inflow resulting in sewage spills and operational problems at the WWTPs.
- The number of spills from GWA's sewage collection system greatly exceeds spill rate norms for similar wastewater systems.
- The GWA reports effluent limit violations at each of its NPDES-permitted sewage treatment plants.
- Each of the GWA's WWTPs had out-of-service or defective equipment.
- Malfunctioning sludge digesters at the Northern District WWTP.
- Regular bypassing of treatment units at the Agat-Santa Rita and Umatac-Merizo WWTPs resulting in discharges of undertreated wastewater.
- Discharges from the Agat-Santa Rita, Baza Gardens, and Umatac-Merizo WWTPs are not disinfected and violate pathogen effluent limits at the WWTPs.
- The GWA is not properly measuring effluent flow rates at its NPDES-permitted sewage treatment plants.

In April 2013, the USEPA issued NPDES permits for the Northern District WWTP and the Agaña WWTP, which established discharge limits consistent with secondary treatment levels and Guam Water Quality Standards, including those for nutrients. Upgrades to both plants are needed to achieve compliance with the current NPDES permit.

In the years since the 2010 Final EIS, the GWA has made progress in complying with the 2011 Court Order including addressing significant findings from the 2012 USEPA NEIC inspection. However, implementation of capital improvement projects and improvements to the operation and maintenance of the existing GWA wastewater infrastructure are in the initial stages and require several years and significant funding to achieve full compliance. A program management consultant has been contracted by the GWA to assist in the management of the required court ordered projects. Some projects have been completed while others are in progress. A consultant has also been contracted by the USEPA through grant funding to provide technical assistance to the GWA related to staff training, asset management, Capital Improvement Plan program planning, and the development SOPs and programs for procurement,

contract administration, construction management and work inspection. Additional technical assistance anticipated to be provided through USEPA's consultant in collaboration with GWA include island-wide asset data collection and conditional assessment and GIS mapping.

In February 2013, the Consolidated Commission on Utilities approved the GWA's Capital Improvement Plan for FY 2013 through FY 2018. The Capital Improvement Plan serves as the GWA's blueprint for creating, maintaining, renewing, and replacing the crucial infrastructure that will support Guam's continued growth. The GWA Capital Improvement Plan incorporates the projects and deadlines identified in the 2011 Court Order and USEPA NEIC findings of significant deficiencies in the GWA's water and wastewater systems. Funding sources for GWA's Capital Improvement Plan projects include internal funding, system development charges, short-term loans, state revolving funds, federal grants, and issuance of bonds.

The island-wide GWA wastewater collection system has undergone periodic inspections and cleaning as required under the 2011 court order. In an effort to comply with the 2011 court order, the GWA is proceeding with infiltration and inflow analyses and sewer system evaluation surveys for the central and southern collection systems and has added on the northern collection system. The goal of the analyses is to collect flow metering and concurrent rainfall data to determine areas likely to be subject to excessive inflow and infiltration. The goal of the sewer system evaluations is to further investigate area likely to have excessive inflow infiltration and to identify its source and quantify the amount. The sewer system evaluation surveys would also include a plan to repair, rehabilitate or replace wastewater collection assets that permit excessive inflow and infiltration to enter the collection system. The inflow and infiltration analyses and sewer system evaluation surveys for southern Guam have been completed; for central Guam the inflow and infiltration analysis is completed and the sewer system evaluation survey is under way; and for northern Guam the inflow and infiltration analysis work was awarded in late 2014.

The inflow and infiltration analyses and sewer survey evaluation surveys in southern Guam were conducted as part of concurrent but separate evaluations that included the Agat-Santa WWTP, Baza Gardens WWTP and the Umatac-Merizo WWTP. The findings of the evaluation of each system is summarized below.

- Agat-Santa Rita: The evaluation of the wastewater system confirmed high levels of inflow and infiltration. Through investigations including closed-circuit television inspection, manhole evaluation, and smoke testing, potential significant contributors to inflow and infiltration were identified. It is anticipated improvements to identified significant contributors would have the potential to reduce the inflow and infiltration by 50%.
- Baza-Gardens: The sewer system evaluation survey identified pipe defects in older pipes generally located in Baza Garden. Manhole defects were generally located in Talafofo. However the identified defects do not appear to be severe enough to cause the high wet weather peaking factors identified by the flow metering and hydraulic modeling efforts. Currently there are four locations in the system that require vacuum pumping twice weekly, and would require additional improvements required to include the installation of four small pump stations.
- Umatac-Merizo: The evaluation of the wastewater system found evidence of significant groundwater infiltration. The evaluation noted the Umatac-Merizo collection system is aging and the pump stations in the system are nearing their end of their useful service life should be included in GWA's island-wide sewer rehabilitation program.

The wastewater system evaluations for southern Guam also considered a regional system combining flows of one or more of the Southern WWTPs. This combination of flows could provide several advantages in cost, operations, and management. Currently GWA is the procurement stage for consultant to design a new wastewater treatment plant on a new site to replace the existing Agat-Santa Rita WWTP. The new WWTP would also treat flows from the Baza Gardens WWTP and would have provisions for possible future expansion to accommodate flows from the Apra Harbor WWTP. The initial design flow would be a dry weather flow of 1.34 MGd (5.1 MLd) and a wet weather flow of 7.77 MGd (29.4 MLd). The total future plant design flow would be a dry weather flow of 4.6 MGd (17.4) and 13.2 MGd (50.0 MLd). In order to meet the requirements of the 2011 Court Order, the GWA will need the proposed Tipalao WWTP operational by December 2016. The proposed site has more space available, but property rights and easements with the DON must be finalized prior to design and construction. A joint WWTP with the U.S. Navy was previously designed for the proposed site, but only the Tipalao pump station that conveys treated effluent from Agat-Santa Rita WWTP to the Tipalao Ocean Outfall was constructed.

GWA's SCADA Master Plan was issued in April 2014. As of 2013, operations of the water and sewer systems were largely standalone, controlled locally and manually operated. Alarm notification is minimal, with abnormal conditions such as sanitary sewer overflows mostly discovered during routine checks or triggered by customer complaints. The goal of the SCADA Master Plan is to provide appropriate instrumentation at each site that is automated both locally and system-wide. Sites would be able to communicate with central computing infrastructure located principally at the future GWA/GPA administration building using GPA's robust island-wide mesh network radio system. The implementation of the SCADA system is planned to occur in several phases over a 6-year period. Construction is anticipated to begin in July 2016 and end in October 2020. With the successful implementation of the SCADA Master Plan, it is anticipated that sanitary sewer overflows will be reduced significantly.

The existing wastewater collection system for Alternative A provides service to DoD installations on Finegayan. This wastewater collection system is primarily a gravity sewer system with two main trunk sewers connected to the GWA wastewater collection system. The existing wastewater collection system discharges to the GWA collection system at a manhole located on Route 3, conveying flows through an existing GWA interceptor sewer ranging in size from 30 inches (76 cm) to 42 inches (107 cm) in diameter along Route 3 that feeds into the Northern District WWTP.

A study was conducted by DoD in support of the 2010 Final EIS to evaluate the GWA sewer capacity along Route 3 and Route 9 from the tie-in at AAFB to the Northern District WWTP. The scope of the study included flow monitoring, a manhole survey, hydraulic modeling, model calibration, and sewer capacity evaluation. Sewer capacity was based on the flow depth to pipe diameter ratio. A sewer pipe was defined as deficient if the modeled flow depth was more than the maximum pipe diameter ratio below:

- For pipe diameter less than 15 inches (38 cm), maximum flow depth to pipe diameter ratio = 0.50.
- For pipe diameter greater than 15 inches (38 cm), maximum flow depth to pipe diameter ratio = 0.75.

Overall, the manhole survey indicated the condition of the manhole interior and covers were in good condition. Manholes that were noted in poor condition with signs of past sulfuric corrosion were located near the AAFB gate. Manholes located on the 42-inch (107-cm) interceptor sewer were noted to have manhole covers in poor condition, but fair interior condition. The hydraulic modeling results for the existing condition indicated the sewer along Route 3 and Route 9 can adequately convey current flows during dry and wet weather conditions. There was one deficient pipe during the wet-weather conditions

located immediately upstream from the Northern District WWTP. However, this did not represent a sanitary sewer overflow condition according to the modeling result and per discussions with GWA is not expected to overflow. This section might warrant additional investigation for any projected increased flow.

A request for information from GWA included recently obtained closed circuit television footage of the main sewer lines from AAFB to the Northern District WWTP, mostly routed along Routes 3 and 9. This footage was reviewed and revealed that the reinforced concrete pipe sewer lines appear to be in a state of deterioration. The recently awarded sewer system evaluation survey should yield additional information on the state of the Northern District sewer collection system, but those results will not be available until after publication of the Final SEIS.

The Northern District WWTP would treat all the direct wastewater flows from active duty personnel and their dependents, the on-base civilian workforce, and industrial flows from on-base facilities. The Northern District WWTP has a design capacity of 12 MGd (45.4 MLd). Interim primary treatment upgrades at the Northern District WWTP were completed in December 2012. A capacity evaluation following the completion of the primary treatment upgrades has shown the Northern District WWTP has the ability to treat wastewater to primary treatment standards up to 9 MGd (34 MLd). The Northern District WWTP is currently not able to meet the new treatment discharge limits of the 2013 NPDES permit. The implementation timeline for planning, designing, constructing, and bringing operational the required treatment system upgrades to meet the new discharge requirements of the 2013 permit requires negotiations between the GWA and the USEPA.

The Northern District WWTP would treat the majority of the increased indirect wastewater flows that would be generated by the temporary construction workforce and induced civilian population. The Agaña WWTP would treat a negligible (<1%) indirect wastewater flows for this alternative. The Agaña WWTP has a design capacity of 12 MGd (45.4 MLd). Interim primary treatment upgrades have been implemented at the Agaña WWTP as of March 2014. The interim improvements at the Agaña WWTP would allow the plant to have an operational capacity to treat wastewater to primary treatment standards up to an average daily flow of 12 MGd (45 MLd). However, with the issuance of an NPDES permit in 2013, the Agaña WWTP currently has no operational capacity to meet the new treatment discharge limits. The implementation timeline for planning, designing, constructing, and bringing operational the required treatment system upgrades to meet the new discharge requirements of the 2013 permit requires negotiations between the GWA and the USEPA.

The southern NPDES-permitted GWA WWTPs include the Agat-Santa Rita WWTP, Baza Gardens WWTP, and Umatac Merizo WWTP. All of these WWTPs have various operational issues requiring compliance actions. There are also some collection system deficiencies requiring attention. As required by the 2011 Court Order, the GWA is planning to upgrade the Agat-Santa Rita WWTP, Baza Gardens WWTP, and Umatac Merizo WWTP by 2018. The southern GWA WWTPs would likely receive wastewater from the indirect induced population resulting from the proposed action, but is not expected to receive wastewater from the indirect construction workforce, which is expected to be housed within the northern wastewater service area.

Solid Waste

The existing solid waste infrastructure has changed since the publication of the 2010 Final EIS. Solid waste continues to be collected and taken off-site for disposal. Currently, DoD contractors pick up waste from the Finegayan site and take it to the Harmon Transfer Station for disposal at the Layon Landfill. Other waste not accepted by the Layon Landfill continues to be disposed at either AAFB or Naval Base Guam Apra Harbor facilities.

The municipal solid waste area of the AAFB landfill is in the closure process. The AAFB landfill construction and demolition waste, asbestos waste, concrete crushing, and green waste mulching areas are planned for continued operation and permitted appropriately.

The DON is currently coordinating with the GEPA regarding the status of the permit for the Naval Base Guam Landfill. The Solid Waste Working Group consisting of the DoD, GEPA, and USEPA was established to coordinate and resolve landfill permitting issues, as well as other solid waste issues on Guam.

One new solid waste initiative being pursued for Guam is the "Guam Zero Waste Plan," dated June 2013, with the goal of reducing solid waste. This GovGuam initiative is partially funded by DoD and OEA, and has DoD support. This initiative has the goals of:

- Developing solid waste targets.
- Mobilizing political leadership and legislation to achieve targets.
- Incentivizing solid waste reduction.
- Developing infrastructure for recycling and resource recovery.
- Implementing a marketing campaign.
- Developing an effective enforcement process.

This initiative has the potential to reduce solid waste generation and disposal challenges.

Information Technology and Communications

The existing IT/COMM utility includes existing DoD and commercial telecommunication duct banks, manholes/handholes, and connection buildings. The existing DoD IT/COMM infrastructure has extensive high bandwidth fiber optic distribution systems present throughout the Finegayan site. This infrastructure includes a system of duct banks and manholes/handholes that feed from existing Building 112 on Finegayan. Based on discussions with Finegayan personnel, the DON telecommunication node at Building 112 has sufficient spare connectivity capacity to provide government telephone and data services for the proposed new facilities. However, the existing telecommunication distribution system does not have capacity to feed the proposed alternative; which would require additional conduit and wiring.

Existing commercial phone and television services at Finegayan are provided through a combination of overhead and underground distribution lines from local service providers. Telephone services at the Finegayan site are currently provided by GTA TeleGuam via the existing Astumbo telephone switching station along Route 3. Television services at Finegayan are currently provided by MCV from an overhead distribution line along Route 3.

4.1.14.2 Environmental Consequences

The assessment of impacts associated with utilities assumed the implementation of sustainability strategies as described in Section 8.6, Sustainability and Smart Growth. These strategies include measures

to achieve federally mandated levels of energy use reduction, water use reduction, waste reduction, and total energy from renewable sources.

Electrical Power

The existing power distribution system at Finegayan is not capable of meeting increased demand from the proposed action. Thus, Alternative A includes an expanded electrical power distribution system and a SCADA system with additional power feeds from the GPA. Based on the load projections for both the cantonment and family housing, no upgrade would be required to the GPA's generating capacity since the total load increase would be within the capacity of their generating plants. However, upgrades to existing 34.5 kV transmission power lines would be required to stay within operating parameters. This electrical power distribution system for Alternative A as described in Section 2.4.4.1 has been developed to handle the increased demand from the proposed action. There would be no direct long-term significant impacts on current power customers, with only potentially short-term power outages during construction of the expanded system. The potential for short-term power outages would be minimized through construction phasing, use of temporary generators, and/or temporary connections to alternative power sources where necessary, which would minimize downtime. Coordination and approval requirements for utility outages would be conducted in accordance with Naval Facilities Engineering Command Marianas Utility Manual. Outage notices would be provided a minimum of 30 days in advance. The island-wide electrical power generating system owned and operated by GPA has adequate capacity to provide for the additional demands from the proposed action.

Based on a load flow analysis performed by the GPA, which took into account all estimated future known DoD electrical loads and estimated increased electrical demand from induced civilian/construction workforce/and organic civilian growth through the year 2028; the load flow analysis indicated the 34.5 kV transmission system from the Harmon Substation to the AAFB Substation would require upgrading. Implementing this upgrade would be required for all proposed alternatives. The upgrade would be installed underground from Harmon Substation to the AAFB Substation. The proposed new Finegayan substation would be a dual feed system from the Harmon Substation and the AAFB Substation, and thus would have more reliable electrical power service as the underground transmission system would better withstand typhoons.

With the proposed improvements to electrical transmission systems and measures to minimize outages during construction, long- and short-term direct impacts to the electrical systems would be less than significant, both during construction and operation.

Potable Water

The existing DoD water system at Finegayan does not have the additional capacity to handle the increased demand from the proposed action. The proposed potable water distribution system for Alternative A as described in Section 2.4.4.1 has been developed to handle the system demands of the proposed action. The current water system serving existing facilities would remain in service, with interconnections to the proposed water system, including the SCADA system, to provide for redundancy and operational efficiency. There are seven active DON water production wells currently producing water on Finegayan and one operational well on standby being used as an aquifer monitoring well. Through the use of BMPs and protective design features, it appears that it may be feasible to keep the DON Finegayan wells in service. Agreement in principle with GEPA on the use of BMPs and protective design features to keep the DON wells in service has been obtained. All construction and operational activities within the wellhead protection zone would be done in accordance with GEPA regulations, as described above. There are also some GWA water production wells in the area along Route 3. Development affecting the GWA wells

would also be subject to GEPA review and potential application of the same BMPs and protective design features.

There would be no significant direct, short-term impact to current DoD water customers as the proposed system would supplement any lost water production. During construction, the proposed system would have excess capacity until the Marine Corps fully occupies the proposed installation. It should also be noted that the water production from the existing Finegayan wells is used to meet demands from both existing facilities and operations at Finegayan, Barrigada and other DON users as needed. It is also anticipated that the proposed water supply wells at AAFB would be installed during the early phases of construction.

The short- and long-term direct impact to the Finegayan DoD potable water system from Alternative A is therefore considered less than significant during both construction and final operational conditions.

DoD Potable Water System

The DoD transmission system needs to form a loop along Route 3, Route 1, and Route 9 and connect the Air Force and DON water systems to effectively and securely convey water to the DoD installations located throughout Northern Guam. The entirety of this transmission loop is not part of the proposed action, but is a future DON/DoD water system goal. The improvements and upgrades to the off-base DoD water transmission system required to support the proposed action would not have any adverse effects upon the existing DoD water system. The construction of the replacement mains could require outages during construction but would be installed adjacent to the existing mains and switched over in phases to minimize water service interruptions to current DoD customers.

As part of the DoD water system improvements to support the proposed action, approximately 11 new water supply wells are proposed to be installed at AAFB. It should be noted that one of the existing wells at AAFB had shown elevated levels of chlorides (relative to the other AAFB wells) in early 2013. AAFB has reduced pumping time for this well in order to maintain lower chloride levels in the system. The NGLA concern and salinity issue are discussed in more detail below.

The short- and long-term direct impacts to the DoD potable water system with the implementation of Alternative A would be less than significant during both construction and during final operational conditions because the improvements would provide adequate potable water to meet current needs, and the proposed Marine Corps facilities would be in compliance with regulatory requirements.

GWA Water System

Overall long-term, direct and indirect potable water impacts from the proposed action include those to the GWA potable water system because of induced civilian growth and the additional construction workforce. The estimated long-term increase in potable water demand to the GWA potable water system would peak during construction around year 2021 at 0.84 MGd (3.18 MLd). This estimate does not include forecast organic civilian growth. The refurbished Tumon-Maui well would provide an additional 1.3 MGd (5.17 MLd) of permitted capacity, but based on USGS recommendations an additional 0.8 MGd (3.18 MLd) rate of water production is preferred for aquifer management purposes. DoD has connection points within DoD water system where it can supply water to GWA, if requested. Some of the connections serving residential/commercial areas are closed because GWA is currently producing enough water in those areas. The GWRDG would coordinate sharing of water between DON and GWA and other water management strategies. The total estimated increased demand on GWA potable water system in the year 2028, including all proposed action-related induced civilian growth and organic civilian growth, would be 3.74 MGd (14.16 MLd), of which 0.28 MGd (1.06 MLd) would be attributable to the proposed action.

It would be expected that the GWA could meet the increased demand both during construction and in the year 2028 when the relocation is scheduled to be completed. Water distribution could be a major issue for the GWA, regardless of whether or not the proposed action occurs. However, the Guam Legislature has recently authorized the GWA to finance improvements to its water system. In addition, an assessment of the northern Guam GWA water system is planned for the near future to establish what improvements should be made. Thus, the short and long-term indirect impact to the GWA water system from the proposed action would be less than significant, due to the small increase in demand from the proposed action. During construction, DoD could supply additional water to the GWA to meet the increased demand from the construction workforce. Thus, the short-term, direct impacts on the GWA water system during construction would be less than significant.

NGLA Water Extraction

Forecasted water demand for Alternative A does not peak during construction, as it would have under the proposed action in the 2010 Final EIS, due to the reduced number of imported construction workers. The forecasted water demand increases steadily through year 2028, due to the indirect impact of induced and organic civilian growth. Total average daily water extraction from the NGLA from all sources (the DoD water system, the GWA water system, and a few private wells) is estimated to be 47.0 MGd (177.9 MLd) in year 2028 (USGS 2013a). With proper management, this quantity is within the estimated sustainable yield of 80.5 MGd (304.8 MLd) (GovGuam 1992).

As discussed in Section 4.1.2.1 of this SEIS, the USGS has developed a numerical groundwater model as a tool to assist water resource managers in estimating the effects of selected groundwater pumping, as well as climate scenarios, on the water supply. The numerical groundwater model is being used to estimate the regional effects to groundwater availability from various withdrawal and recharge scenarios that include the increased withdrawal due to the proposed action and all other known future DoD actions, as well as organic growth of the Guam civilian population. The results from the model assist water resource managers in planning, designing, and managing water systems that will produce a sustainable and reliable freshwater supply (USGS 2013a). The results of the USGS study confirm the recharge rate of the NGLA used in the GovGuam (1992) study, but indicate that increased withdrawal from the NGLA may result in higher levels of chloride concentrations as compared to the 2010 base year scenario. The model indicates that these chloride concentration spikes would be a localized phenomenon, in which simulated salinity levels (i.e., measured by chloride concentration) in three wells (two GWA and one DoD) in the Finegayan basin moved into the cautionary classification. However, by redistributing withdrawal rates among the extraction wells, it could be possible to meet the water demands and maintain acceptable salinities over all existing and proposed GWA and DoD wells. There are connection points within the DoD water system where water can be supplied to GWA if needed. While some of these connections serving residential/commercial areas are closed because GWA is currently producing enough water in those areas, DoD has the ability to reopen or restore these connections and provide water to GWA if GWA decreases its production.

The USGS model has limitations due to uncertainties regarding the actual conditions within the aquifer. As more data become available for inclusion in the model, the reliability of results can be improved. According to the USGS study, additional efforts are needed to improve the model, including the rehabilitation and expansion of the hydrologic data collection network, as well as monitoring to ensure sustainable management of NGLA (USGS 2013b). Specifically, this would require rehabilitation of 12 existing deep monitoring wells, placement of 7 additional deep monitoring wells in basins with little or no monitoring coverage, closure of one existing monitoring well, relocation of one existing monitoring well

due to proposed widening of Route 3, and establishment of a periodic maintenance program (USGS 2013b).

Based on the above, the operation phase of Alternative A could result in short-term, localized significant impacts to the affected basin within the NGLA but less than significant impacts to the overall NGLA. The significance of groundwater impacts resulting from implementation of Alternative A would be similar to that associated with implementing Alternatives B, C, D and E.

As potential mitigation for the localized significant impact, the DoD would, as appropriate, implement enhanced water conservation measures for the proposed action, improve existing water systems to reduce system leaks, adjust pumping rates at DoD wells, use existing wells, and/or increase the use of surface water from Fena Reservoir to reduce withdrawals from the NGLA.

The DoD would continue to support the GWRDG and would support the USGS's recommendation to rehabilitate and expand the hydrologic data collection network and monitoring necessary to ensure sustainable management of NGLA. The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including rehabilitation and expansion of the NGLA monitoring well network. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

Therefore, the groundwater model, along with an improved network of wells to monitor groundwater levels and water quality, would be used to sustainably manage the NGLA. The USGS/UOG-WERI would conduct periodic monitoring of the aquifer groundwater chemistry to optimize the system and adjust pumping rates if chloride levels show an increase. This would ensure increased pumping does not adversely affect military or non-military sources of potable water. Monitoring the chloride concentrations in the basins and maintaining the capability to shift pumping to wells further from impacted basins if high chloride concentrations are detected, would reduce potential negative short- and long-term impacts on this groundwater resource. This approach would also allow adjustments in pumping to address changes in precipitation patterns resulting from climate change or long-term drought.

To ensure sustainable management of the NGLA, the DoD supports expansion of the hydrologic data collection network and monitoring, including rehabilitation and expansion of current water-resource monitoring in the NGLA. The DoD would include the rehabilitation and expansion of the hydrologic data collection network (i.e. deep monitoring wells) in the EAC's implementation plan. The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan which will address assistance to support public infrastructure requirements necessary to support the preferred alternative. As appropriate, the EAC process will support the identification of specific projects utilizing DoD funds via the OEA to support public infrastructure requirements, and would address the requirement for installation of deep monitoring wells and monitoring of NGLA.

Proposed activities in the July 2010 MOU establishing the GWRDG include the following:

- Cooperation among the parties in completing studies related to meeting the water needs of Guam including NGLA sustainability studies, which will be coordinated with the GEPA, the USGS, and the UOG/WERI, as needed.

- Cooperation among the parties in selection of future water well sites.
- Cooperation among the parties in developing appropriate plans for the integration of new water production and distribution infrastructure with existing water systems.
- Shared water resources as needed to address urgent needs using DoD/GWA water system connection points where can be exchanged between the two systems if requested. Some of these connections serving residential/commercial areas are closed because GWA is currently producing enough water in those areas. The GWRDG would coordinate sharing of water between DON and GWA and other water management strategies.
- Discuss appropriate adjustments to pumping rates of GWA and DoD wells to resolve any water quantity and quality issues.

Groundwater Under the Direct Influence of Surface Water

In a December 2013 formal letter to the GWA, GEPA declared that Guam's groundwater is not considered GWUDI of surface water. Therefore, all such designated production wells would not be required to have additional water treatment above what is currently being performed.

Wastewater

Wastewater generated from Alternative A would be collected and conveyed to the Northern District WWTP for treatment and disposal. The DoD estimates for wastewater flows to the Northern District WWTP are summarized in Table 4.1.14-1. Direct wastewater flows include all wastewater flows that would be generated by active duty personnel and their dependents, the on-base civilian workforce, and industrial flows from on-base facilities. Indirect wastewater flows include increased flow from induced civilian population growth resulting from the military relocation, increased construction workforce, and all other anticipated DoD projects. The forecasted organic Guam civilian population growth also contributes to the increase in future wastewater flow to the plant.

Table 4.1.14-1. Northern District WWTP Wastewater Flows

Wastewater Impact	*Total Monthly Average Flow (MGd)*	*Total Monthly Maximum Flow (MGd)*	*% Increase Average Flow from Baseline*
Baseline	5.1	11.48	NA
Notional Increase	2.68	4.77	NA
Direct[1]	1.23	2.08	24%
Indirect[2]	0.61	0.81	12%
Guam Civilian Growth	0.84	1.88	16%
Total Future Flows (2028)	**7.78**	**16.25**	**53%**

Notes: [1]Direct includes only project, or cantonment/family housing, and new incoming Marine Corps personnel.
[2]Indirect includes non-project, other DoD, and induced impacts, including ACE. NA = not applicable.

As shown in Table 4.1.14-1, the total future flow at the steady state year 2028 for this alternative, which includes the flow from the proposed action and Guam civilian growth, is estimated to increase the average baseline flow by 53% at the Northern District WWTP. The estimated direct and indirect wastewater flows represent a 36% increase from the baseline.

The existing wastewater collection system at Finegayan cannot handle the increase in demand from the proposed action. The proposed wastewater collection system for Alternative A, as described in Chapter 2 of this SEIS, has been developed to handle all current flows for areas served by the current Finegayan wastewater collection system, in addition to the increased flows from the proposed action. The proposed

wastewater collection system would connect to the GWA collection system along Route 3 through a relief sewer. The pump stations will connect to the SCADA system at the central monitoring station.

In 2010, the DON conducted a sewer capacity study (DON 2010) using a hydraulic model developed for the GWA WRMP that was modified and calibrated with 2010 flow monitoring data. Based on the flow scenario in the sewer capacity study (which was similar to the 2010 Final EIS proposed action estimated flows), the GWA interceptor sewer along Route 3 and Route 9 can adequately convey dry- and wet-weather flows. The GWA interceptor sewer ranges in size from 30 inches (76 cm) to 42 inches (107 cm) in diameter along Routes 3 and 9. There is one segment of each sewer size where the maximum flow depth could be three quarters of the pipe diameter at peak flows. Updated sewer collection system model runs were completed and the results show that the existing sewers have adequate capacity to handle the projected flow in year 2028. However, in late 2014 the DON obtained closed circuit television footage from GWA of the main sewer lines from AAFB to the Northern District WWTP, mostly routed along Routes 3 and 9. Based on available information from closed-circuit television footage of the Northern District WWTP collection system, the concrete reinforced pipe sewer line from AAFB to the Northern District WWTP along Routes 3 and 9 is in a state of deteriorated condition that requires rehabilitation or replacement. Therefore, this operations impact is significant but mitigable.

GovGuam received funding from USEPA to conduct the sewer system evaluation survey in northern Guam. GWA awarded a sewer system evaluation survey contract of the northern collection system in late 2014, but those results were not available at the time of publication of the Final SEIS.

The Northern District WWTP currently treats wastewater to primary treatment standards. The 2013 NPDES permit for the plant requires discharge to meet secondary treatment and Guam Water Quality Standards, including those for nutrients. The Northern District WWTP requires upgrades to meet the NPDES permit standards. Until the required upgrades are operational, additional projected wastewater flows from the proposed action and all other sources would be treated to primary treatment standards. Increasing the wastewater flow to a non-compliant treatment plant would be a significant direct impact during the period of non-compliance with the permit. Because some of the proposed construction would occur during this period of non-compliance, there would be direct and unmitigable significant impacts to the wastewater system until the Northern District WWTP upgrades are completed.

The significance of impacts for Alternative A is the same as that assessed for Alternatives B, C, and E. Upgrading the Northern District WWTP to current treatment standards (as required by the 2013 NPDES permit) would mitigate significant impacts to the wastewater system on Guam. The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

The required improvements to treatment from the newly issued NPDES permits need an agreed upon timeline for implementation. Obtaining funding, performing design and construction, and bringing the new portions of the WWTP into operational status is a time-consuming endeavor and must be given a reasonable time for proper implementation. Ultimately, this is dependent upon the GWA and the USEPA reaching an agreement on a suitable implementation timeline.

The Agaña WWTP would not receive direct DoD wastewater flows from the proposed action, but would be indirectly affected by the military relocation due to increased wastewater flows from the induced civilian growth. The DoD estimates for wastewater flows to the Agaña WWTP is summarized in Table 4.1.14-2.

Table 4.1.14-2. Agaña WWTP Wastewater Flows

Wastewater Impact	*Total Average Day Flow (MGd)*	*Total Monthly Maximum Flow (MGd)*	*% Increase from Baseline*
Baseline	5.3	7.0	NA
Notional Increase	0.9	1.2	NA
Direct[1]	0.00	0.00	0%
Indirect[2]	0.04	0.06	0.8%
Guam Civilian Growth	0.88	1.16	16.6%
Total Future Flows (2028)	**6.2**	**8.2**	**17%**

Notes: [1]Direct includes only project, or cantonment/family housing, and new incoming Marine Corps personnel.
[2]Indirect includes non-project, other DoD, and induced impacts, including ACE. NA = not applicable.

As shown in Table 4.1.14-2, the total future flow for the steady-state year 2028 is estimated to increase baseline flow by 17% at the Agaña WWTP. However, only a very small percentage of the estimated increase is from indirect impacts from the proposed action.

Treatment upgrades are also required for the Agaña WWTP. The situation with the Agaña WWTP is similar to the Northern District WWTP with the requirement of primary treatment upgrades (already implemented as required by the 2011 Court Order) and treatment upgrades as required by the 2013 NPDES permit. Under Alternative A, the increased wastewater flows from the proposed action would be from induced civilian growth (0.04 MGd) and considered negligible (less than 1% of the total projected flow [see Table 4.1.14-2]). Therefore, consistent with impact assessment criteria in this SEIS, the impact from the proposed action to Agaña WWTP would be less than significant.

The GWA southern WWTPs (Agat-Santa Rita WWTP, Baza Gardens WWTP, Umatac-Merizo WWTP, and Inarajan WWTP) would not receive direct DoD wastewater flows from the proposed action, but would be indirectly affected by the military relocation, due to increased indirect wastewater flows from the induced civilian growth, as well as organic civilian growth in the region. The increased wastewater flow from indirect impacts from the proposed action to the four southern WWTPs is estimated to total 0.02 MGd (0.08 MLd); a small percentage of the total capacity of the plants. Upgrades to the GWA southern WWTPs are required under the 2011 Court Order and planning and design are in progress. The Guam Legislature has recently authorized the GWA to finance improvements to its wastewater system. Due to the negligible estimated increased flow to these southern treatment and collection systems from indirect sources, the long-term direct and indirect impact of the proposed action on southern GWA wastewater systems would be less than significant.

Increased sewage flow from the proposed action would be handled by the existing GWA sewer lines mostly along Routes 3 and 9 from AAFB to the Northern District WWTP. As discussed in the affected environment section, these lines are in a state of deterioration. The increased flow from the proposed action could accelerate this deterioration and result in significant impacts to this portion of the Northern district sewer collection system. Potential mitigation would be rehabilitation or replacement of the sewer lines.

Other Impacts During Construction

During construction of the proposed action, less than significant impacts would result from potential service outages and sewage spills. The impacts for Alternative A are the same as those assessed for Alternatives B, C, D, and E. These impacts would be minimized through compliance with the DON's utilities outage procedures and implementation of BMPs such as: coordination with utility providers and permitting agencies, and prior to excavation identifying existing underground utility lines through utility research, toning, or potholing. Other potential BMPs may include constructing sewers during low flow periods, by-pass pumping, and having pump trucks on stand-by.

Other Impacts During Operation

Other long-term direct operational impacts related to implementing the proposed action would include increases to power demands; operator staffing and training; sludge handling; fats, oils and grease; and industrial wastewater. These impacts would be partially offset by the Marine Corps contributing to the GWA revenues for operations and maintenance as a new rate paying customer, by payment of a service development charge, and by BMPs such as the implementation of an on-base program to control fats, oils, and grease with grease traps and the pretreatment of industrial wastewater with oil-water separators or other applicable pretreatment systems. Therefore, these operational impacts would be less than significant. The impacts for Alternative A are the same as those assessed for Alternatives B, C, D and E.

Solid Waste

The environmental consequences for the solid waste utility associated with the population buildup for Alternative A are generally limited to planned construction of a solid waste transfer station and recycling facility as described in Chapter 2 of this SEIS. The existing Guam solid waste infrastructure consisting of the Layon Landfill and Harmon Transfer Station have adequate capacity to accept the increased generation of wastes for the proposed action. Existing solid waste services would continue during construction. The DON updated the Final Comprehensive Construction and Demolition and Solid Waste Management Plan for Guam Military Relocation, including the green waste management sections. The Utilities and Site Improvement (U&SI) contractor would be required to process/compost green waste on-site. As part of construction waste management, contractors would be required to submit a green waste processing/composting plan to the DON and obtain required solid waste permits for green waste processing and composting from GEPA. The DON would review the contractors' project-specific waste management plans prior to their submittal to GEPA and would provide oversight during the construction. C&D debris generated during the buildup would be handled by the utilities and site improvements (U&SI) contractors at a designated laydown area. The U&SI contractor would be required to divert all the green waste and a minimum 60% of the C&D debris from disposal. The larger-sized green waste consisting of trees and stumps would be processed into mulch and the smaller-sized green waste would be processed into compost. The C&D debris would mainly consist of concrete that would be crushed and used as lower-graded aggregate. Construction and demolition debris would be processed for reuse or disposed in permitted facilities in accordance with all regulatory requirements, EOs, and DoD requirements.

After the proposed Solid Waste Transfer Station and Recycling Center are built at the cantonment, the handling of solid waste would be integrated with the new facilities. The long-term increase in solid waste generated by the additional DoD population at Finegayan would be managed by the new transfer station, recycling center, and planned additional solid waste handling trucks/equipment. The off-base long-term, direct impact would consist of increased solid waste container trucks hauling the processed municipal solid waste to Harmon Transfer Station, and recycled waste to the designated recycling contractors (e.g.,

cardboard, scrap metal, glass). The potential long-term, direct impact on the Guam solid waste infrastructure support systems would be less than significant.

The new Layon Landfill is designed to account for the level of municipal solid waste projections from the 2010 Final EIS. Therefore, it has the capacity to accommodate the projected municipal solid waste for the reduced levels of the current proposed action. The reduction in the generation of solid waste under the current proposed action versus the 2010 proposed action is a beneficial effect, because this substantially reduces the amount of landfill waste over time than was previously planned. The C&D debris and green wastes that cannot be recycled or reused, as well as wastes that are prohibited at Layon Landfill would be disposed in existing disposal facilities in accordance with all regulatory requirements, EOs, and DoD requirements. The Layon Landfill and the permitted private hardfill facilities are operating within their regulatory requirements. The proposed action would be in compliance with all applicable GEPA solid waste permit terms and conditions that routinely include specific measures to protect human health and the environment. Therefore, there would be less than significant long-term direct and indirect impacts to the solid waste resources on Guam for Alternative A, both during construction and operation.

Information Technology and Communications

The current DoD IT/COMM infrastructure at Finegayan would remain in place during and after the proposed new facilities are constructed and in operation. Any existing lines for areas that would be under new roads, parking lots, or other areas subject to loads at ground surface would have to be encased in concrete, and several existing communication lines would require rerouting. During this rerouting construction, close coordination with Naval Computer and Telecommunications Station operations would be required to ensure any critical communication lines impacted would be kept in operation via alternate signal routing. Existing Building 112 currently has adequate connection capacity to handle additional IT/COMM connectivity that would be required by the proposed alternative at Finegayan, but additional distribution of conduit and lines would need to be installed to properly interconnect the DoD communications requirements. New duct banks required for Alternative A as described in Chapter 2 of this SEIS include a duct bank of up to twelve 4-inch (10-cm) conduits looped between the main IT/COMM distribution facilities, as well as a system of duct banks and various conduits distributed in and around the site connecting the main distribution facilities to each building or end user. Various cables types would be required within this system of conduits, including 144 and 288 strand fiber optic cables, copper cables with 600 pair telephone lines, and smaller cables to individual buildings.

Additional inter-base IT/COMM connectivity would be required as described in Chapter 2. This includes the connection between AAFB and the existing Tata cable landing facility in southern Guam, which would require new rights of way along some southern roads and the access road to the Tata facility.

The current commercial IT/COMM facilities have adequate capacity within nearby infrastructure. Both GTA TeleGuam and MCV have indicated that the commercial telephone and television switches have capacity for the proposed new facilities, but would require new duct banks within Finegayan. Existing duct banks for the commercial system could be rerouted for the proposed new development should that be required. This could cause short-term interruption to commercial service, of less than 1 day, during the construction phase; but with no permanent or long-term consequences to the IT/COMM commercial infrastructure.

Therefore, the overall short- and long-term, direct impact to IT/COMM would be less than significant, both during construction and in operation.

4.1.15 Socioeconomics and General Services

Because of the relatively small size of the island of Guam, most of the anticipated socioeconomic impacts resulting from implementation of the proposed action are expected to affect the island as a whole. Therefore, much of the discussion in this section is not focused on geographical variations, as in other resource sections of this SEIS. This section begins with an Affected Environment section that provides a current (i.e., updated from the 2010 Final EIS) and historical perspective on Guam's socioeconomic status, including Population Characteristics, Economic Characteristics, Public Services, Sociocultural Issues, and Land Acquisition. This section provides the baseline context for the analysis of the relocation of Marines to Guam, which is relevant to all alternatives presented in this chapter. A socioeconomic impact analysis, that is also relevant to all action alternatives, is then provided with respect to five components of Environmental Consequences: Population Impacts, Economic Impacts, Public Services, Sociocultural Impacts, and Land Acquisition Impacts.

This section of this SEIS also summarizes a detailed socioeconomic impact assessment performed in 2012-2013 to update and revise the 2010 SIAS conducted for the 2010 Final EIS (Volume 9: Appendix F). The updated SIAS is provided in its entirety in this SEIS as Appendix D. It was prepared with the best available information at time of writing on relevant topics such as construction conditions, military personnel numbers, and relocation schedules.

4.1.15.1 Affected Environment

A comprehensive discussion of the affected environment pertinent to Guam's socioeconomic attributes and general services is presented in the 2010 Final EIS (Volume 2, Chapter 16: Affected Environment, pages 16-1 to 16-66). The following affected environment description includes information from the 2010 Final EIS as well as any significant updates to the 2010 SIAS.

Historical and Economic Overview

Guam's socioeconomic history has been heavily influenced by over 300 years of Spanish rule, historic American occupation, the battles of WWII and Korea, and the Japanese occupation. Since WWII, Guam's economic history has been volatile, led by changes in population and global events in the military, social, and natural spheres.

Post-war reconstruction and the formation of new U.S. military bases in the 1940s and 1950s were the basis for Guam's first major economic expansion and the initial placement of contemporary infrastructure. In the 1960s, Guam's tourist industry grew due to the lifting of visitor security clearance requirements and the initiation of Pan American Airway services from Japan to Guam. This growth also led to indirect growth in related industries such as construction, recreational fishing and diving, commercial fishing and retail trade.

Guam's economy stagnated in the 1970s and early 1980s, partially in response to the 1973 Organization of the Petroleum Exporting Countries oil embargo. Construction activity and visitor arrivals declined over the decade. In the latter part of the 1980s, Cold War military spending and the closing of U.S. bases in the Philippines increased Guam's military population (including dependents) to a level not seen since the 1960s (up to 23,790 in 1987), thereby adding to its economic base. However, the military population on Guam fell through the 1990s due to the relocation of some temporary troops and the closure of Naval Air Station Hagåtña, as shown in Table 4.1.15-1. Guam saw a drastic increase in visitors in the mid-1990s, but this dropped off significantly at the end of the decade due to the collapse of Asian financial markets

and the crash of a Korean Air Lines plane. While visitor numbers have increased since that low mark, the peak levels experienced in the mid-1990s have yet to be recaptured.

Table 4.1.15-1. Combined Military and their Dependents Population on Guam, Selected Years

1950	*1960*	*1970*	*1980*	*1987*	*1990*
26,617	23,300	19,777	20,000	23,790	19,610
1993	*1994*	*1997*	*2000*	*2007*	*2013*
22,077	15,865	13,002	11,624	12,337	13,112

Sources: U.S. Census Bureau 2000; GBSP 2013; JRM Total Force Manpower 2013.

From 2000 through 2013, Guam's economy has continued to mirror its volatile recent past. From 2001 to 2003, Guam's economy contracted. Unadjusted for inflation, total payroll declined by 2%, employment declined by 4%, and individual salaries increased by 1%. From 2004 to 2006, partially in response to the announcement of the proposed action, Guam's economy showed signs of expansion. In 2005 tourism was the island's second largest private industry (following the Finance, Insurance, and Real Estate sector) and both the primary Japanese and secondary Korean market were growing at that time. Many real estate developments were financed and constructed in anticipation of the military buildup as proposed in 2010.

Between 2008 and 2011, Guam's tourism industry continued to show weakness. Following the March 11, 2011 Japanese earthquake and tsunami, the decline in tourism activity culminated with a large decline in visits from Japan. This large decline in Japanese tourism set the stage for a turnaround. In response to weak tourism (primarily a product of weak Japanese visitor numbers), the Guam Visitors Bureau made a decision to attempt to attract visitors from other countries. Guam Visitors Bureau increased Guam's visibility in Korea and Taiwan by increasing marketing activities. There was a good response to the additional promotion and Korean and Taiwanese markets responded. Visitor arrivals from those two nations began to increase in 2011. As the Japanese economy began to recover, Japanese tourism visits to Guam also began to recover. Consequently, Korea, Taiwan and Japan generated enough visits to make 2012 and early 2013 record breaking in terms of numbers of visitors, surpassing levels set in the mid to late 1990s. Additionally, Guam has seen an over 200% increase in visitors from Russia, due to the visa waiver program that began in January 2012 (Guam Visitors Bureau 2013).

Not all of Guam's major economic sectors have recovered so well from recent economic turmoil. Guam's real estate market remains stagnant in part due to the investments in real estate and projects that were started in anticipation of the military buildup but stopped and/or re-directed when plans for the buildup were delayed. As investor expectations related to the buildup have been fading, so has activity in the real estate market. In 2012, real estate sales volume on Guam eclipsed 2008 sales volume for the first time, but this data masked a continuing weakness - over half of 2012 sales volume was made up of only five large transactions. Without these five large sales, total sales volume would have been down by 25% from 2011, and down by 67% from the 2007 peak. Also showing weakness in the real estate market in 2012 were single family home sales, which declined from 2011 levels (Captain, N. and Captain Real Estate Group 2013).

Population Characteristics

Guam's population as of the most recent full U.S. Census of 2010 was 159,358. The island's population has grown significantly since Guam became a U.S. Territory in 1950. From 1950 to 2000 Guam's population grew at an average rate of 21% per decade (about 2.1% annually). However, population growth tapered off since then and is expected to stabilize over the next 20 years at around 1.5% per year.

Demographics

Between 1990 and 2000, the percentage representation of Chamorro and Caucasian ethnicities in Guam's population declined, while Filipino and "Other" ethnicities (most often composed of other Asian or Pacific Islander ethnicities) increased. Guam's ethnic makeup changed little from 2000 to 2010. In 2010, 42% of Guam residents were Chamorro or part Chamorro, 25% were Filipino, 8% were other Pacific Islanders, 7% were Caucasian, and 17% were of other races or ethnicities.

As of 2010, 42.5% of Guam's population lived in households in the island's northern region. Both Dededo and Yigo had larger average household sizes than Guam's overall household average. Compared to Guam overall, Dededo and Yigo had a higher percentage of family households, married family households, and married family households with children. Household incomes in Dededo and Yigo were lower than the overall average household income for Guam. Dededo had a higher percentage of family households living below the poverty line (18.2%) than Guam overall (16.1%) but Yigo had a lower percentage (15.1%).

North. As of 2010, 41% of Guam's population resided in the northern region (villages of Dededo and Yigo). The region was 50.3% male and 49.7% female compared to the overall Guam population (51.2% male and 48.8% female). Ethnically, the northern region was less Chamorro than the rest of Guam (32% compared to 43%). Dededo was far more Filipino than the rest of Guam (43% vs. 26%) and Yigo was more heavily populated with Caucasians than the Guam average (11% vs. 7%). The median age of the population in the northern region was similar to that of Guam's overall population. Dededo's median age was 28.8 years old and Yigo's is 26.7 years old compared to Guam's overall median age of 29.5 years old. A lower percentage of people in the northern region were born on Guam compared to the rest of the island. Similar to the ethnicity of the areas, a proportionally large percentage of Dededo's population was born in the Philippines (29%) and a proportionally large percentage of Yigo's population was born in other areas of the United States (19%).

Central. The Central region was occupied by over 44% of Guam's household population. The Central region had a lower number of persons per household than Guam and fewer households were family households than Guam as a whole. Six of the ten Central region villages had higher average household incomes than Guam overall. The highest average household income was Piti ($61,094) and the lowest was Hagåtña ($37,083). Seven of the 10 villages had a lower percentage of families living below the poverty line than Guam as a whole.

South. As of 2010, the southern region was occupied by about 19% of Guam's household population. Households in this region were on average larger and more likely to be family households than Guam overall. Households in the southern region had higher incomes than Guam overall and the region also had slightly higher income per household member. While incomes, on average, in the southern region were higher than Guam overall, the village of Umatac had the highest percentage of families living below the poverty line in all of Guam.

Military Demographics

Military populations can affect the composition and growth of villages on Guam. Dededo and Yigo have higher proportions of military residents relative to other villages. Between 1990 and 2000, these two villages experienced rapid population growth: Yigo's by 37% and Dededo's by 35%. The more service- and tourism-based village, Tamuning, experienced population growth of 8% during the same period. However, population growth drastically slowed for Yigo and Dededo between 2000 and 2010, growing by only 5.5% and 4.6%, respectively. Tamuning's population grew by 9.3% during the same decade.

Guam's active duty military population has remained constant at about 6,200 from 2004 through 2011, but declined in 2012 and 2013 to approximately 4,750 personnel. The total active-duty population on Guam in 2013 was at the lowest level in the past 15 years, since 1998.

Economic Activity

Employment and Income

Employment by Industry. Table 4.1.15-2 shows the industry employment composition of Guam's economy between 2000 and 2011. Construction and manufacturing jobs increased while the number of jobs in all other industries declined.

Table 4.1.15-2. Guam Civilian Employment by Industry, 2000 and 2011

Industry	*2000 Number*	*% of 2000 Total*	*2011 Number*	*% of 2011 Total*	*Change 2000-2011 Number*	*% Change 2000-2011*
Agriculture	290	0.4%	210	0%	-80	-0.1%
Construction	4,440	7%	5,860	10%	1,420	2.3%
Manufacturing	1,620	3%	1,740	3%	120	0.2%
Transportation & Public Utilities	4,980	8%	4,250	7%	-730	-1.2%
Trade	14,260	24%	13,810	23%	-450	-0.7%
Finance, Insurance & Real Estate	2,660	4%	2,640	27%	-20	-0.0%
Services	15,140	25%	16,250	4%	1,110	1.8%
Federal government (excl. active-duty military)	4,440	7%	4,130	7%	-310	-0.5%
GovGuam	12,740	21%	11,930	20%	-810	-1.3%
Totals	**60,570**	**100%**	**60,820**	**100%**	**250**	**0.4%**

Source: GBSP 2012.

Occupational Profile. Table 4.1.15-3 shows employment by occupation for Guam during the years 2000 and 2011 and the percentage change in employment in each occupation over that time period. From 2000 to 2011, as measured by the U.S. Bureau of Labor Statistics, Guam added 2,560 jobs (from 57,000 to 59,560), an increase of 4.5%.

More jobs were held in Office and Administrative Support occupations than any other occupation. Common jobs under this category include executive secretaries and administrative support, customer service representatives, and various clerking positions. The number of jobs in many occupational categories increased by over 20% during this time period, including jobs in construction and extraction, healthcare practitioners and technical fields, architecture and engineering, community and social services, computer and mathematical fields, and legal occupations. Jobs in sales, building and grounds cleaning and maintenance, and arts, design, entertainment, sports, and media each declined by over 10%.

Table 4.1.15-3. Guam Employment by Occupation, 2000 and 2011

Occupation	*Employment (number of people)*		
	2000	*2011*	*% Change*
Office and administrative support	10,090	10,630	5.4%
Food preparation and serving related	6,360	6,090	-4.2%
Sales and related	5,530	3,890	-29.7%
Management occupations	4,960	5,080	2.4%
Construction and extraction	3,380	5,650	67.2%
Education, training, and library	3,600	4,200	16.7%
Transportation and material moving	4,120	3,740	-9.2%
Building and grounds cleaning and maintenance	3,660	2,990	-18.3%
Installation, maintenance, and repair	3,000	3,700	23.3%
Personal care and service	1,720	1,620	-5.8%
Protective service	2,370	2,380	0.4%
Business and financial operations	2,090	2,270	8.6%
Production	1,810	1,710	-5.5%
Healthcare practitioners and technical	1,230	1,520	23.6%
Architecture and engineering	750	970	29.3%
Community and social services	360	550	52.8%
Healthcare support	690	770	11.6%
Arts, design, entertainment, sports, and media	590	530	-10.2%
Computer and mathematical	260	670	157.7%
Life, physical, and social science	290	360	24.1%
Legal	140	240	71.4%
Total	**57,000**	**59,560**	**4.5%**

Source: U.S. Bureau of Labor Statistics 2012.

Income Profile. From 2000 to 2011, as measured by the U.S. Bureau of Labor Statistics, median salary for Guam jobs increased by $4,497 (from $22,890 to $27,387) an increase of 19.6%.

The highest salaries were found in legal occupations, management analyst occupations, and architecture and engineering occupations. Salaries in architecture and engineering, transportation and material moving, building and grounds cleaning and maintenance, and food preparation and serving increased by over 30%. Salaries in legal occupations declined and salaries in life, physical and social science occupations grew by less than half of 1%.

Price Adjusted Income. Changes in salary, over time, can best be understood in terms of purchasing power. Purchasing power is how much somebody can buy with their income. Purchasing power increases if salaries increase faster than prices but purchasing power decreases if prices increase faster than salaries.

Although the median salary on Guam increased by 19.6% from 2000 to 2011, consumer prices on Guam increased by 55% during that same period, and purchasing power decreased by 22.8%. A 22.8% decline in price adjusted income means that a person working the same job at the same income could purchase 22.8% fewer goods and services in 2011 than they could have in 2000.

Table 4.1.15-4 illustrates the effect that price changes have on income. Salaries in the table are divided by the Guam price index. The price index in 2011 reached a value of 155.0, so 2011 salaries are divided by 1.55 and are thus reduced by 55%.

Table 4.1.15-4. Guam, Price Adjusted Median Annual Salary by Occupation, 2000 and 2011

Occupation	*Median Annual Salary (Adjusted for Prices)*		
	2000	*2011*	*% Change*
Legal	$61,460	$35,671	-42.0%
Management analysts	$43,320	$32,052	-26.0%
Architecture and engineering	$37,700	$32,310	-14.3%
Computer and mathematical	$37,770	$25,697	-32.0%
Healthcare practitioners and technical	$34,870	$27,471	-21.2%
Business and financial operations	$36,660	$28,452	-22.4%
Life, physical, and social science	$38,870	$25,187	-35.2%
Education, training, and library	$27,960	$20,354	-27.2%
Community and social services	$30,320	$21,639	-28.6%
Installation, maintenance, and repair	$24,420	$16,432	-32.7%
Construction and extraction	$24,710	$17,303	-30.0%
Arts, design, entertainment, sports, and media	$19,920	$16,394	-17.7%
Protective service	$23,820	$17,890	-24.9%
Office and administrative support	$20,320	$15,174	-25.3%
Healthcare support	$20,180	$14,652	-27.4%
Production	$19,350	$13,568	-29.9%
Personal care and service	$18,100	$12,161	-32.8%
Transportation and material moving	$16,900	$14,206	-15.9%
Sales and related	$15,330	$12,271	-20.0%
Building and grounds cleaning and maintenance	$13,490	$11,677	-13.4%
Food preparation and serving related	$13,670	$11,465	-16.1%
Employment Weighted Average	**$22,890**	**$17,669**	**-22.8%**

Source: U.S. Bureau of Labor Statistics 2012.

Unemployment. Table 4.1.15-5 shows Guam's civilian labor force numbers between the years 2000 and 2012. Between the years 2000 and 2004, Guam's civilian labor force experienced drastic decline. It began expanding again in 2004.

From 2007 to 2011 Guam's labor force increased substantially to the point where, even with an increase in number of persons employed, the unemployment rate increased. However, the number of people in the labor force and the number of employed persons dropped substantially between 2011 and 2012, lowering Guam's unemployment rate to 11.8%. Guam's unemployment rate of 11.8% in March of 2012 was higher than the national rate of 8.2% at that time. Guam has no unemployment insurance program.

The 2010 Census data shows that 73% of those working on Guam were employed in three adjoining urban districts: Hagåtña, Dededo, and Tamuning. Also, nearly half were employed in three industries: accommodation and food service, retail, and construction (Guam Department of Labor 2011).

As of March 2011 there were 1,842 H-1 and H-2 workers on Guam (Guam Department of Labor 2011). Section 214.2(h) of Title 8 of the U.S. CFR grants certain conditions under which temporary employees may come to the U.S. for temporary work under the H-1 and H-2 programs, particularly if U.S. citizens cannot be found to capably perform the work.

Table 4.1.15-5. Guam Employment Trends 2000-2012

Year[1]	*Civilian Labor Force*	*Labor Force Participation Rate*[2]	*Employed*	*Unemployment Rate*
2000	70,800	67.8%	59,950	15.3%
2001	64,800	64.5%	56,040	13.5%
2002	62,050	62.4%	54,980	11.4%
2004	61,520	61.7%	56,810	7.7%
2005	64,130	61.1%	59,630	7.0%
2006	65,940	62.9%	61,390	6.9%
2007	63,600	57.8%	58,290	8.3%
2009	70,310	61.7%	63,800	9.3%
2011	74,950	62.6%	64,970	13.3%
2012	68,400	56.6%	60,340	11.8%

Notes: [1]Data for 2008 and 2010 were not available.
[2]The labor force participation rate is the percentage of the adult population 16+ either employed or unemployed but actively seeking employment.
Source: Guam Department of Labor 2012.

Housing Supply and Characteristics

As of the 2010 Census there were approximately 50,560 housing units on Guam. Almost 17% were vacant.

During the early portion of the 2000s, while Guam's economy was in recession, both real estate prices and the construction of new housing units fell, bottoming out in 2003. In 2004, real estate prices began to rise again, in response to improving worldwide economic conditions and initial discussions of the proposed military relocation, spurring new construction. The year 2007 marked a peak in the dollar value of residential and land sales. Land and condominium prices seemed to bottom in 2009 and have been stable since. However, in 2012, single family home sales continued their decline from 2007 levels. Single family home sales in 2012 had a total dollar value of $124.6 million, down 12% from 2011 levels. The median price of a single family home also dropped 12% from 2011 to 2012. The 2012 median home price on Guam was $216,675 (Captain Real Estate 2013).

North. In 2010, the northern region had a total of 18,716 housing units (12,829 in Dededo and 5,887 in Yigo). This comprised 37% of the total number of housing units on Guam. Prices were lower in the northern region than Guam overall both in terms of median value and rents. Overall, Guam had a very high vacancy rate (15.2% in 2010, compared to the U.S. nationwide figure of 11.4%). The northern region had a lower vacancy rate than Guam overall. The northern region, on average, had fewer renter occupied units as a percentage than Guam overall (meaning there were more owner-occupied units than Guam as a whole). Housing units were slightly larger in the northern region compared to Guam overall. Both Dededo and Yigo had more rooms per unit and more bedrooms per unit than the Guam overall average.

Central. As of the year 2010, the Central region had a total of 24,442 housing units. This comprised 48% of the total number of housing units on Guam. The Central region had an even higher vacancy rate than Guam's overall high rate of 15%. Tamuning, Hagåtña, Sinajana, and Piti all had vacancy rates over 20%. However, most of the vacant units were available for rent. In general, the Central region had a higher rate of renter occupied units than Guam overall (50%). Housing units were smaller in the Central region compared to Guam overall. Hagåtña had the smallest sized units on Guam, with an average of 3.7 rooms and 1.9 bedrooms per housing unit. Despite the smaller units in the Central region, prices were higher in Guam overall, both in terms of median value and rents.

South. As of the year 2010, the southern region had a total of 7,409 housing units. This comprised 15% of the total number of housing units on Guam. The southern region overall had a lower vacancy rate than Guam's overall rate of 15%, and fewer were available to be rented. On average, the southern region had a lower rate of renter occupied units than Guam overall. Housing units were larger in the southern region compared to Guam overall. Both Santa Rita and Yona had the largest units on Guam in terms of number of rooms per unit and number of bedrooms per unit. Despite the larger units in the southern region, prices were generally lower than overall Guam, with five of the seven villages having lower median home values.

Temporary Workforce Housing

Based on information from Guam construction contractors and the Guam Department of Land Management, there was capacity to house 3,700 temporary workers in 2009. Over half of this capacity (1,900) was owned and operated by one contractor at a single location in Harmon Industrial Park. The remainder of the capacity (1,800) was spread among 17 different locations, mostly in the north and central regions (JGPO and NAVFAC Pacific 2009). Since then, the two major builders of temporary workforce housing began construction of developments that could have ultimately housed up to 26,500 residents, to accommodate the proposed military buildup. However, the scope reduction of the buildup has in part led to a reduced the number of units actually constructed to date, and some units that have been constructed were converted into affordable housing for permanent residents. For example, the first phase of the Ukudu Workforce Village opened in 2011 and was designed to house 2,000 residents by the end of the year, but was unused as of June 2012 (Matthews 2012). If the Village is completely built out, it could accommodate up to 18,000 temporary residents (Torre 2011). Data provided by the Department of Land Management indicate that, as of January 2013, there was capacity to house approximately 4,200 temporary workers.

Government of Guam Finances

Guam residents pay federal income taxes but those taxes are returned to GovGuam. Most sources of tax revenue go to the Guam General Fund while some other tax revenues go into a variety of other governmental funds.

Government of Guam Revenues

In FY 2011, GovGuam had revenues totaling $1.1 billion. Tax revenues ($553 million) accounted for most of the revenue and most of the remainder came from federal contributions ($426 million). Of that total $1.1 billion in revenue, $552 million went to the General Fund, $131 million went to other governmental funds, $281 million came from Federal Assistance Grants and $136 million came in the form of federal grants to the Guam Public School System. Section 30 federal income tax collections totaled more than $46 million in 2011. These funds are generated for GovGuam through federal tax payments of military personnel stationed on Guam.

Government of Guam Expenditures

In FY 2011, GovGuam spent more on public education than any other expenditure category. $265 million was spent on public education, not including payments made to the UoG and GCC. In total, one-third of all GovGuam expenditures went to education. Public health, capital projects, and general government were the three next highest expenditure categories. Over $78.8 million was spent paying interest on GovGuam debt during FY 2011.

Gross Island Product

GIP measures the total value of all final goods and services produced in a particular economy. It is the most commonly used benchmark to gauge the overall size of an economy. The most recent measure of GIP on Guam was completed in 2010, when it was estimated that Guam's GIP was about $4.58 billion.

Tourism

The tourism sector is a major driver of Guam's economy. In FY 2012, there were an estimated 1.3 million visitors to Guam (Guam Visitors Bureau 2012) and early data for 2013 are encouraging.

Public Services

Public services are a key part of any relationship between citizens and their governments. They represent the primary benefits that individuals receive from their payment of taxes. In theory, as tax revenues change, the quality and quantity of public services would as well, with a positive correlation. As government tax revenues increase, the services provided by that governments have the capacity to improve and, likewise, as government revenues decline then public services may suffer.

Education Services

Primary and Secondary Education. Primary and secondary education for Guam's civilian residents is provided through the Guam Department of Education (GDoE), which was formerly known as the Guam Public School System. A number of private schools on Guam also provide primary and secondary education. There is currently one approved charter school on Guam but as of January 2013, this school has yet to open. School-age children of active duty military and some other U.S. federal employees attend schools in the DoD Domestic Dependent Elementary and Secondary Schools System. Including all primary and secondary schools on Guam, fall enrollment for School Year 2011-2012 was 40,262 students (GBSP 2012).

In School Year 2011-2012, GDoE employed 3,377 FTE teachers and staff positions including:

- 1,281 Elementary Teachers
- 590 Secondary Teachers
- 556 High School Teachers

GDoE has identified the need to construct no less than four additional schools (two elementary schools, one middle school, and one high school) due to the growing island population. The agency is renovating existing schools and plans to build three new schools, though funding has not been identified to do so.

Higher Education. Publicly provided higher education services on Guam are offered by the UoG and GCC. Private higher education services on Guam are provided by Pacific Islands University. Guam Department of Education, UoG, and GCC work together through the Joint Educational Board (referred to as the "Tri-Board"). The Tri-Board oversees teacher certifications and seeks to develop productive and efficient linkages between the three entities. UoG employed a total of 819 people in academic year 2012-2013, including 397 faculty. Of the 397 faculty, 185 are employed on a full-time basis and 212 on a part-time basis (UoG 2012). In academic year 2012-13, GCC had 238 staff, including 115 non-adjunct faculty positions, 89 general support staff, and 34 administrators. Additionally, there were about 94 adjunct (non-permanent) faculty positions (GCC 2013).

Health and Human Services

Health services involve the preservation of health and the prevention, treatment, and management of illness through the professions of medicine, dentistry, nursing and allied health. Human Services can incorporate a range of agencies and services including support of low-income, specially identified, or at-risk populations.

As of 2011, Guam had two hospitals, including Guam Memorial Hospital and one Naval hospital, 30 pharmacies, and 77 clinics (GBSP 2012). A new private hospital known as Guam Regional Medical City is under construction and is expected to be completed by the summer of 2014.

As of 2012, staffing for public health services providers on Guam included the following:

- Guam Memorial Hospital Authority (GMHA) employed 1,077 medical staff, including 94 physicians and 506 nurses and allied health professionals.
- Guam Department of Integrated Services for Individuals with Disabilities (GDISID) employed 25, including eight social workers. This number has decreased over the past 2 years from 33 staff.
- Guam Behavioral Health and Wellness Center (GBHWC) had 197 staff positions, of which 69 are mental health professionals. Thirty-nine critical positions remain unfilled including psychiatrist, psychologist, and behavioral analyst positions. GBHWC indicated in public comments on the Draft SEIS that in 2014 GBHWC had 196 professional and support staff.
- GDPHSS employed the following numbers of key staff:
    - Bureau of Primary Care Services - 70 full-time staff including eight physicians and two nurses.
    - Bureau of Family Health and Nursing Services - 36 full-time staff including 22 nurses.
    - Bureau of Communicable Disease Control - 42 full-time staff including 20 health professionals and 6 laboratory technicians.
    - Division of Environmental Health - 22 full-time staff.

Since 1988, Guam has been considered a Medically Underserved Area (GDPHSS Maternal and Child Health Services 2007), demonstrating the island's difficulty in meeting its health care needs. Its remote location means access to specialized care is reduced. It has been difficult to recruit specialists from the U.S. mainland because of Guam's remote location and lower pay scales. Guam qualifies as a Health Professional Shortage Area; because of this, certain medical professionals (e.g., nurses, mid-level providers, chiropractors, health dentists, psychologists) can enter the National Health Service Corps, work at Guam medical facilities and receive a federal government salary, be compensated for relocation costs, and receive school loan repayment benefits. While importing health professionals helps with shortages, systemic turnover created by the temporary nature of the National Health Services Corps program makes it difficult to provide a stable level of care over the long term.

Public Safety

Public Safety services include the protection from and prevention of events that could endanger the public, including crime and disasters both natural and man-made. Government agencies on Guam involved in law and traffic enforcement, fire prevention and suppression, emergency medical response, safety inspections, and civil and criminal litigation, justice, and corrections are all considered public safety agencies.

In 2012, staffing for the public safety services on Guam included the following:

- GPD employed 303 sworn officers and 66 civilian personnel, these included part-time employees, those who only worked for a short period of time, and unpaid volunteers (of which there were over 100 in 2012).
- Guam Fire Department (GFD) employed approximately 258 full time sworn personnel, including emergency medical technicians. Approximately 34 of these personnel are qualified to perform open water rescues.
- Guam Department of Corrections (GDoC) employed a full-time staff of 214. Of these staff, 195 work in custody and security, 5 in casework and counseling, 3 in behavioral health services/infirmary, and 11 in administration. GDoC has 58 vacant positions available.
- Guam Department of Youth Affairs (GDYA) had 87 FTE staff positions, 44 of which were youth service workers. Low pay levels and resources make it difficult for GDYA to hire and retain staff. In public comments, GDYA indicated that in 2014 it had 45 youth service worker positions filled.

Judiciary of Guam and Selected Agencies Affected by Population Growth

The agencies discussed in this section were selected because they would likely be impacted by increases in service population or an increase in H-2B construction workers.

The Judiciary of Guam (JoG) is a co-equal branch of the government of Guam (holding equal status as the executive and legislative branches of the territorial government). It consists of the Courts and Ministerial Division, Probation Services Division, Marshal's Services Division, Client Services and Family Counseling Division, and Procurement and Facilities Management Division. The DoD and JoG have concurrent jurisdiction on some crimes. Cases can be juvenile, child custody, child abuse, family violence, and divorce.

As of 2012, staffing for the JoG and other selected agencies affected by population on Guam include the following:

- JoG employed nine judges and 361 FTE supporting staff. The JoG has a low employee turnover rate and recruitment difficulties are minimal and related mostly to certified positions (e.g., certified counselors).
- GDPR's 2012 staffing was less than 80 employees. Park ranger, teacher, and park maintenance positions are primarily outsourced.
- The Guam Public Library System (GPLS) employed a staff of 24 in 2012. Library technicians handle a variety of tasks to maintain the continuing operations of the library system. In public comments GPLS indicated that in 2014 staffing levels had dropped to 21 FTEs due to reorganizational mandates and budgetary constraints.

Other agencies for which staffing levels were reviewed include the Guam Customs and Quarantine Agency (139 total staff in 2014) and the Guam Department of Administration (114 total staff in 2014).

Agencies Affected by Development

The agencies discussed in this section were selected because they would likely be impacted by increases in development and construction on Guam as a result of the proposed action. They are GovGuam agencies responsible for issuing, monitoring and enforcing development permits on Guam.

Because actions on federal land do not require local development permits, most of the impact on GovGuam development permitting functions would come from off-base growth generated by the

proposed action (i.e., purchases from construction or operations and from indirect growth). In a few cases, such as the USEPA, federal agencies have delegated responsibility for oversight of direct project activities to local agencies, and so the direct project impacts also affect local permitting, monitoring, and enforcement to some extent.

In 2012, employees were assigned to permitting/monitoring duties within each agency as follows:

- Guam Department of Land Management assigned five full-time employees.
- GEPA assigned 48 full-time workers. Indicated in comments on the Draft SEIS that number should be updated but provided no updated staffing information.
- GDPW assigned six full-time workers.
- Guam Coastal Management Program had six full-time workers assigned to permitting and monitoring activities.
- Guam Department of Agriculture assigned two full-time workers.
- GWA assigned five full-time workers.
- Guam SHPO assigned six full-time workers.

In FY 2012, the Guam Department of Labor Alien Labor Processing and Certification Division (ALPCD) employed five full-time employees. In their comments on the Draft SEIS, GDOL and ALPCD indicated that in 2014 there were three full-time employees and three temporary staff. Guam Coastal Management Program indicated in its comments on the Draft SEIS that in 2014 GCMP had: 2 Planner III's, 1 Planner II, 1 Program coordinator, 1 Administrative Assistant, 1 Detailed Interim Administrator, and 1 Program Coordinator.

The existing permit approval and enforcement processes timelines have been delayed due to inadequate staffing levels. The time it takes to obtain a development permit has slowed some construction projects (SIAS Appendix B, Guam Contractors Association).

Sociocultural Issues

Sociocultural issues are topics that relate to how factors that unify communities and ways of life can change due to external influences that become involved in a culture. For example, the U.S. military has engaged in foreign basing and U.S. military culture has been introduced to foreign cultures though direct interaction with communities. The introduction of U.S. military culture in every case changed the host community's culture. Guam is not a foreign country and the U.S. military is already integrated into Guam's culture, but the proposed action may affect the level of integration and lead to changes in some sociocultural issues.

Political and Chamorro Issues

The political administration of Guam has undergone many changes and its political status as an unincorporated Territory of the U.S. continues to be a topic of public debate. Some members of the Guam community have expressed concern that increased military activity on the island weakens Guam's ability to change or "improve" the Territory's political status. Similarly, although there has never been a recorded majority of voters on Guam in favor of full independence from the U.S., a political goal of some Chamorros has been independence of the island, and they feel that any increase in military activity strengthens the sense of "colonization" on Guam and decreases the possibility of achieving independence.

There is also concern about the growing "minoritization" of Chamorros. Past labor shortages and the Compact of Free Association have resulted in increases in Filipinos and non-Chamorro Micronesians within the population. The military was a driver of initial Filipino population increases and continues to

drive Caucasian and other Mainlanders coming to Guam. Increasing numbers of other ethnic groups on Guam, as a percentage of population decreases the percentage of population that is Chamorro, contributing to minoritization.

Crime and Social Order

Tourism, the military, and periodic construction spikes have all been perceived to create markets for alcohol, illegal drugs, prostitution, and illegal gambling on Guam. Such issues emerged as concerns during public dialogue about the proposed action and its attendant construction phase during the preparation of the 2010 Final EIS. Information on recent crime rates is presented in Section 3.5.6 of Appendix D. In general, crime has increased steadily over the past decade; however, the violent crime rate generally decreased during this time period. Overall, the rates of violent and property crimes are lower on Guam than in the U.S. as a whole.

Community Cohesion

Chamorros expect people to approach their relationships with the wider society conforming to the philosophy of "respetu" (in the Chamorro language it means respect or veneration). This philosophy involves respecting the environment and society where the individual lives. Chamorros are held to infa'maolek and respetu by a strong sense of "mamahlao," or shame. A proper Chamorro has a sense of mamahlao in social situations, and does not openly contradict a superior or act outside of social mores (Guam Department of Chamorro Affairs 2003).

Guam's temporary foreign workers (H-2Bs) are generally regarded as law-abiding. However, there has been some historical experience with foreign construction workers who have overstayed their visa terms (SIAS Appendix B, ALPCD) or, due to unfamiliarity with local customs, have disturbed local communities. For example, temporary foreign workers have upset residents by harvesting marine animals normally not consumed on Guam (species considered too small), and by taking shells and corals to the point where reefs have been damaged (SIAS Appendix B, GBSP). In-migrants from Federated States of Micronesia are viewed by some as not adopting sustainable fishing practices (SIAS Appendix B, Fisherman's Coop).

Conflicts between local and in-migrant customs have also been related to housing and living conditions. For example, up to 15 or 20 individuals from these groups have been reported to reside in a single housing unit, and there are stories of subdivided lots without sewer connections or other infrastructure being sold by unscrupulous developers to Micronesians, who find it natural to live in the "traditional" rural style found on their home islands (2010 Final SIAS Appendix D, GCA and Guam Housing and Urban Renewal Authority; SIAS Appendix A, GDPHSS). These problems can occur because public health standards are not the same from island of origin to host island.

Based upon existing information, the education level completed by Freely Associated States of Micronesia in-migrants is low when compared to Guam and U.S. national averages. Few have college degrees and just over 50% have graduated from high school (General Accounting Office 2001). In-migrants from the Freely Associated States of Micronesia are also disproportionately represented in crime statistics. Of GPD offenses charged where race was noted, the Freely Associated States of Micronesia population represented 33% of the total; in addition, approximately 21% of inmates in the GDoC have Federated States of Micronesia nationality and the GDYA indicates that 40% of their population are Chuukese (SIAS Appendix B, GPD, GDoC, GDYA).

First recorded in 1899, U.S. military-civilian conflicts on Guam centered on fights due to the sale of liquor to Sailors and Marines, and subsequent "drunkenness" (Rogers 1995). Occasional personal conflicts occur around all military bases throughout the world and regardless of country or nationality. Guam Naval Base Security information shows that out of nine recorded off-base assaults involving military in 2008, and 12 in 2009, all involved civilians.

4.1.15.2 Environmental Consequences

Five broad socioeconomic categories are analyzed in this section: Population Change, Economic Activity, Public Services, Sociocultural Issues, and Land Acquisition. Beneficial impacts, adverse impacts, and significant impacts of a mixed nature are identified. However, as a whole, and particularly in comparison to the impacts that were identified in the 2010 Final EIS, the general conclusion for socioeconomics and general resources is that there would not be major adverse changes to Guam's existing socioeconomic infrastructure as a result of the proposed action in this SEIS.

Impacts related to population change would be mixed with some adverse and some beneficial outcomes. Population increases would result in increased demand on Guam's public services agencies, but also increased economic activity and GovGuam tax revenues. Economic impacts presented in this section are total impacts; they include impacts that would be generated by the proposed action both directly and indirectly. Overall economic impacts would be long-term and beneficial, and Guam's housing stock and availability would be able to absorb the estimated increase in demand for housing.

Impacts to public services agencies presented in this section are total impacts, and include impacts related to both direct and indirect population or development. Impacts to some types of public services agencies would be significant. These impacts would be related to additional agency staffing required to meet demands from additional population associated with the proposed action. Significant impacts to public services agencies would be, for the most part, short-term, lasting for the few years during which population impacts would be greatest (2021 through 2023 as shown in Table 4.1.15-6), due to the influx of temporary construction workers.

There is a potential for sociocultural impacts to occur, but the magnitude of the impacts is difficult to predict and could vary substantially based on policy and program choices yet to be made as to how to address them.

Potential impacts associated with Land Acquisition are noted in this chapter. However, because none of the cantonment/family housing alternatives would require land acquisition and some of the LFTRC alternatives would, impacts associated with Land Acquisition are analyzed more thoroughly in Chapter 5.

<u>Population Change</u>

Table 4.1.15-6 shows the growth of population related to the proposed action over the period of 2015 to 2028. It indicates that a maximum total impact in population increase of 9,721 would occur in 2023 and that a steady-state population increase of 7,412 would be reached in 2028.

Figure 4.1.15-1 compares total population on Guam with and without the proposed action. Between the years 2021 and 2023 population with the proposed action is 5.6% higher than it otherwise would have been, without the proposed action. At a steady-state, which would begin in 2028, the difference would be 4.1%.

Table 4.1.15-6. Estimated Total Population Increase[1] from SEIS Proposed Action (Relative to Base Year 2014)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*
Direct DoD Population[2]														
Active Duty Marine Corps[3]	25	35	35	35	387	2,990	3,319	3,319	4,282	4,282	4,779	5,000	5,000	5,000
Marine Corps Dependents	8	11	11	11	118	908	1,008	1,008	1,300	1,300	1,300	1,300	1,300	1,300
Civilian Military Workers	4	5	38	75	113	150	188	225	263	300	338	338	338	338
Civilian Military Worker Dependents	4	5	35	71	107	143	179	214	249	285	320	320	320	320
Off-Island Construction Workers (DoD Projects)	161	1,071	2,301	3,227	2,871	2,587	3,175	2,978	2,205	1,350	618	46	0	0
Dependents of Off-Island Construction Workers (DoD Projects)	56	343	667	839	660	517	635	596	507	351	179	15	0	0
Direct DoD Subtotal	**258**	**1,470**	**3,087**	**4,259**	**4,256**	**7,295**	**8,504**	**8,339**	**8,806**	**7,868**	**7,533**	**7,019**	**6,959**	**6,959**
Indirect and Induced Population														
Off-Island Workers for Indirect/Induced Jobs[4]	46	130	271	338	349	455	548	529	462	361	308	257	228	227
Dependents of Off-Island Workers for Indirect/Induced Jobs	43	124	260	325	337	441	533	517	453	355	304	255	227	227
Indirect/Induced Subtotal	**89**	**254**	**531**	**663**	**686**	**897**	**1,082**	**1,046**	**915**	**716**	**612**	**513**	**455**	**453**
Total Population	**347**	**1,724**	**3,618**	**4,922**	**4,941**	**8,191**	**9,585**	**9,386**	**9,721**	**8,584**	**8,145**	**7,532**	**7,414**	**7,412**

Notes:

[1] Population increases shown are not additive from year to year. They represent the aggregate project related increase as of any given year (relative to Base Year 2014 population before project implementation) and not an annual increase.

[2] DoD population includes military personnel, DoD civilian workers and dependents from off-island.

[3] Active Duty Marine Corps numbers do not include transient Marines. There would be 200 additional transient marines visiting five times per year for 2-3 weeks at a time.

[4] Population figures do not include Guam residents who obtain employment as a result of the proposed action.

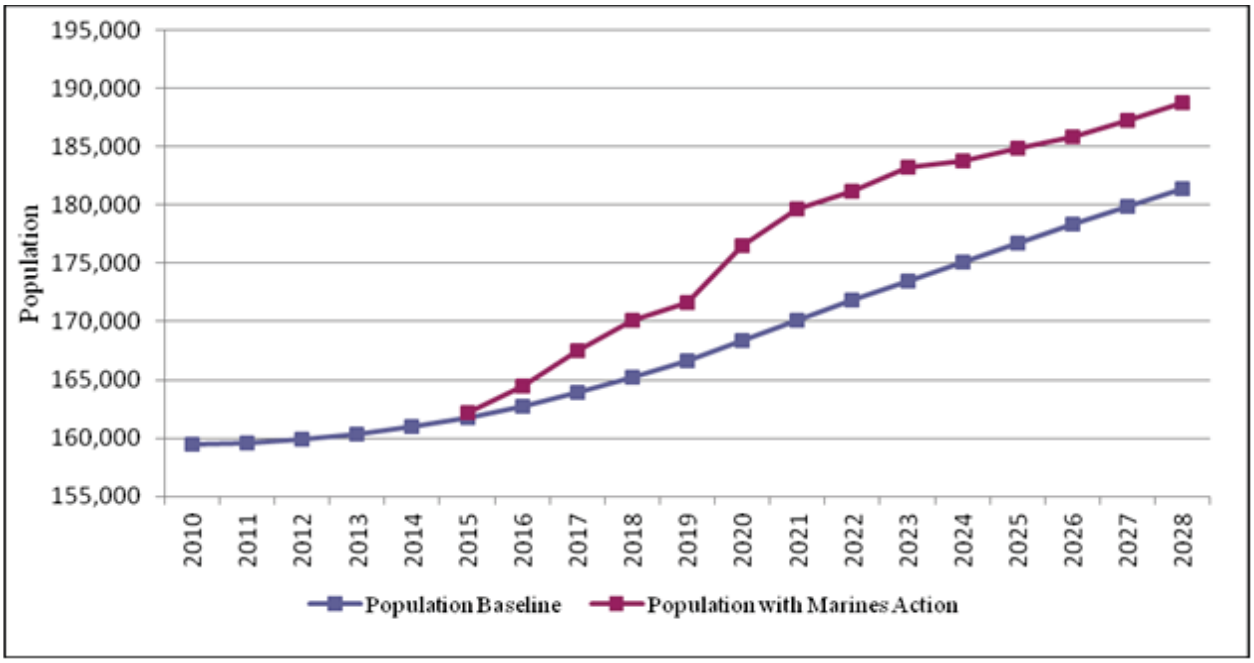


Figure 4.1.15-1 Project-Related Population with and without the Proposed Action

While the population change associated with the proposed Marine Corps relocation would be considered significant during both the construction and operation phases (given that population change would exceed 2%), the significant change would not be considered entirely negative. Impacts related to population change would be mixed, with some adverse and some beneficial outcomes. Population increases would bring about increased demand on Guam's public services agencies, but also increased economic activity and GovGuam tax revenues, as discussed in the following sections.

No potential mitigation is proposed, as the population increase would not likely result in a considerable increase in demand on Guam's public services and permitting agencies, and the estimated increases in GovGuam tax revenues would likely compensate for any increased demand on public services that would occur.

Economic Activity

The economic impacts would be beneficial, leading to increased employment and standards of living, and impacts to Guam's housing stock and availability would not bring about reactionary development, which could have otherwise lead to dislocations in the housing market.

Civilian Labor Force Demand

Table 4.1.15-7 shows the proposed action would support a maximum of 7,031 FTE jobs. This maximum number of jobs would occur in 2021. After 2021, the number of civilian sector jobs associated with the proposed action would begin to decline until the steady-state level of 1,438 jobs would be reached in 2028.

Table 4.1.15-7. Impact on Civilian Labor Force Demand (FTE Jobs)

	2015	***2016***	***2017***	***2018***	***2019***	***2020***	***2021***	***2022***	***2023***	***2024***	***2025***	***2026***	***2027***	***2028***
Direct Construction Impact	419	1,457	2,895	4,102	3,941	3,782	4,391	4,205	3,249	2,174	1,217	466	85	0
Indirect Construction Impact	143	490	1,092	1,374	1,354	1,435	1,759	1,662	1,210	750	406	156	28	0
Total Construction Impact	**562**	**1,947**	**3,988**	**5,477**	**5,295**	**5,217**	**6,150**	**5,867**	**4,459**	**2,924**	**1,623**	**621**	**113**	**0**
Direct Operations Impact	42	56	102	149	226	449	535	587	707	761	863	878	878	893
Indirect Operations Impact	20	27	39	50	91	301	346	359	448	462	521	538	538	546
Total Operations Impact	62	83	141	200	317	750	881	946	1,154	1,223	1,384	1,416	1,416	1,438
Combined Direct Impact	**461**	**1,513**	**2,997**	**4,251**	**4,167**	**4,231**	**4,926**	**4,792**	**3,956**	**2,935**	**2,080**	**1,344**	**963**	**893**
Combined Indirect Impact	**163**	**517**	**1,131**	**1,424**	**1,445**	**1,736**	**2,105**	**2,021**	**1,658**	**1,212**	**927**	**694**	**566**	**546**
Combined Total Impact	**624**	**2,030**	**4,129**	**5,677**	**5,612**	**5,967**	**7,031**	**6,813**	**5,613**	**4,147**	**3,007**	**2,037**	**1,529**	**1,438**

Notes: Portion assumed to be filled by Guam residents is not subtracted from these figures. Numbers may not add exactly due to rounding.

Figure 4.1.15-2 compares total labor force demand on Guam with and without the proposed action. In 2021, civilian labor force demand with the proposed action would be 11.9% higher than it otherwise would have been, without the project. At 2028, the difference would decline to 2.4% - both representing a beneficial impact. At maximum, the significance of the increase in labor force demand would be considered short-term; however, during brief periods of economic expansion, businesses may be created that could improve the long-term quality of goods and services on Guam. These quality improvements may not show up in economic projections but may serve to improve the QOL for Guam residents. The significance of the increase in labor force demand during the steady-state period would be considered long-term and would represent a sustainable form of economic growth on Guam.

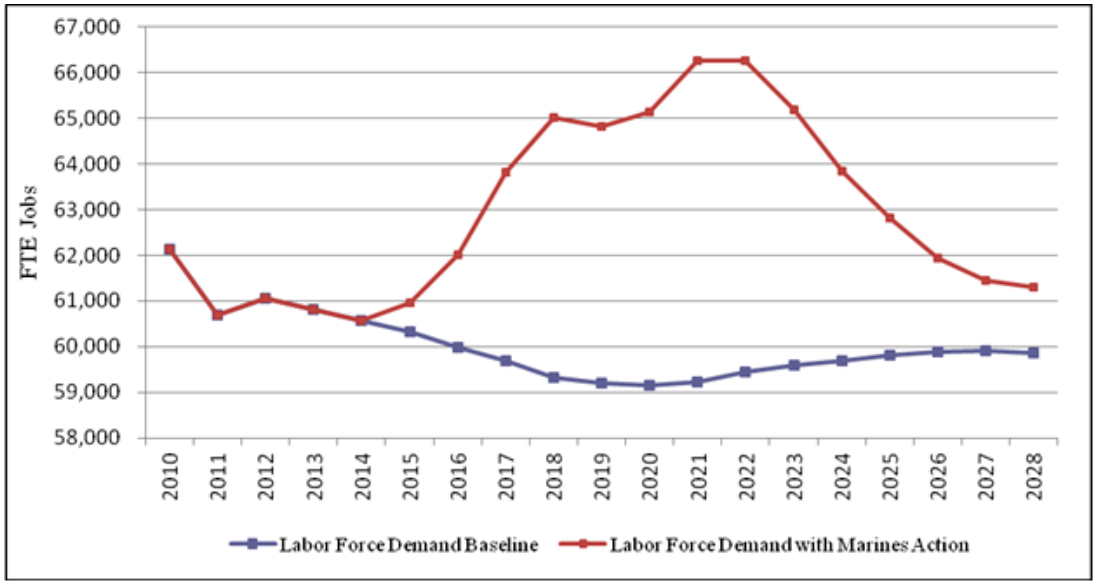


Figure 4.1.15-2 Labor Force Demand with and without the Proposed Action

Probable Sources of Labor Supply

An estimated maximum number of 1,227 workers from Guam would work on construction projects related to the proposed action. A maximum of 3,227 workers from off-island would work on construction projects related to the proposed action. It is anticipated that the majority of off-island construction workers would be H-2B workers from the Philippines and other Pacific Islands. During the later years of construction (2025-2026), it is anticipated that more workers from Guam than from off-island would work on construction projects related to the proposed action.

Civilian Labor Force Income

Table 4.1.15-8 shows that labor income on Guam associated with the proposed action would reach a maximum of $296 million in 2021 and decline to a steady-state value of $67 million by 2028.

Figure 4.1.15-3 compares total income on Guam with and without the proposed action. When impacts are at their maximum, civilian labor force income would be 15.6% higher than it otherwise would have been without the proposed action. At 2028, the difference would decline to 3.1% - representing a beneficial impact at the maximum and during the steady-state period. The increase in civilian labor force income would be substantial as it is a representation of overall higher prosperity on Guam. Higher overall prosperity does not mean that all residents would become better off, but overall, as income increases, the general level of prosperity on Guam would increase.

Table 4.1.15-8. Impact on Civilian Labor Force Income (Millions of 2012 $s)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*
Direct Construction Impact	$13	$47	$104	$133	$130	$136	$165	$157	$115	$72	$39	$15	$3	$0
Indirect/Induced Construction Impact	$7	$25	$56	$72	$70	$74	$90	$85	$62	$39	$21	$8	$1	$0
Total Construction Impact	**$21**	**$72**	**$160**	**$204**	**$200**	**$209**	**$255**	**$242**	**$177**	**$111**	**$61**	**$23**	**$4**	**$0**
Indirect/Induced Operations Impact	$1	$1	$2	$2	$4	$14	$17	$17	$21	$22	$25	$26	$26	$26
Total Operations Impact	**$3**	**$4**	**$7**	**$10**	**$15**	**$34**	**$41**	**$44**	**$53**	**$57**	**$64**	**$66**	**$66**	**$67**
Combined Direct Impact	**$15**	**$50**	**$109**	**$141**	**$141**	**$156**	**$189**	**$184**	**$147**	**$107**	**$78**	**$55**	**$43**	**$41**
Combined Indirect Impact	**$8**	**$26**	**$58**	**$74**	**$74**	**$88**	**$107**	**$102**	**$83**	**$61**	**$46**	**$34**	**$27**	**$26**
Combined Total Impact	**$24**	**$76**	**$167**	**$214**	**$215**	**$243**	**$296**	**$286**	**$230**	**$168**	**$125**	**$89**	**$70**	**$67**

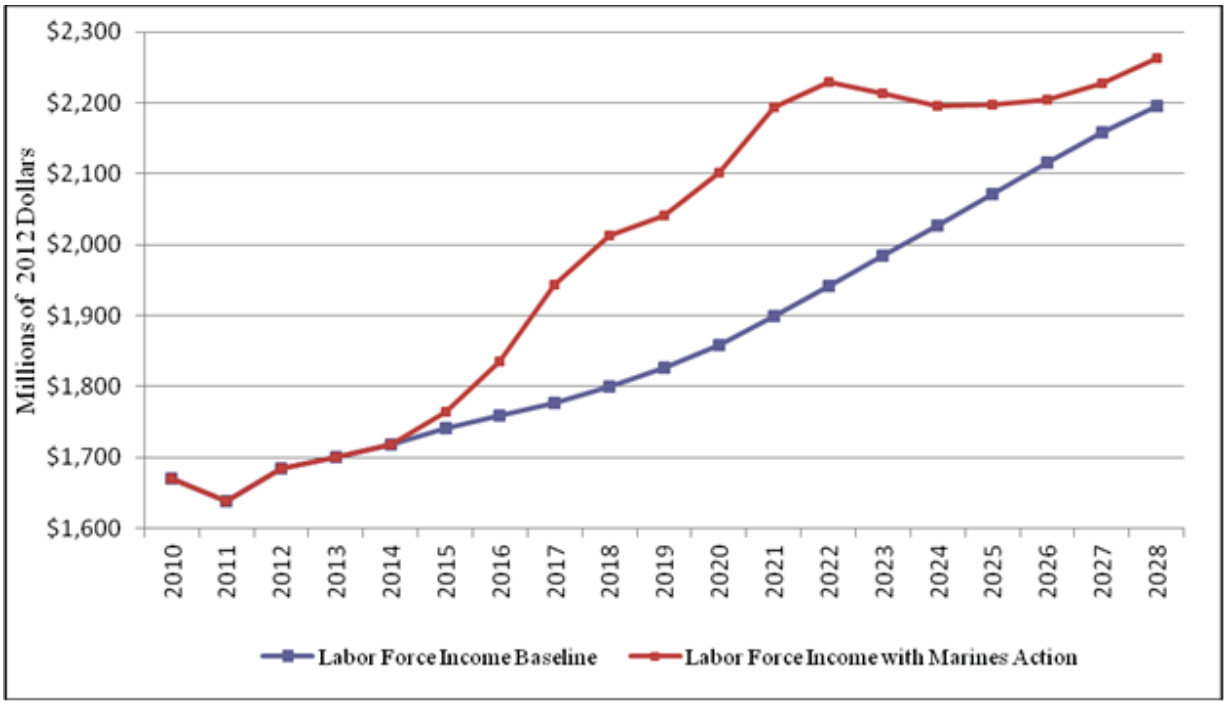


Figure 4.1.15-3 Civilian Labor Force Income with and without the Proposed Action

Government of Guam Tax Revenues

GovGuam tax revenues are expected to increase by a maximum of $86.4 million in 2021 and reach a steady-state level of $40 million in 2028. Personal income tax and Section 30 revenue are estimated to be the primary driver of GovGuam tax revenue impacts associated with the proposed action (72% of total tax revenue impacts in 2021 and over 90% of revenue impacts during the steady-state). Table 4.1.15-9 provides summary GovGuam tax revenue impact summary data.

Table 4.1.15-9. Impact on GovGuam Tax Revenue Summary
(Thousands of 2012 $s)

Tax	*Maximum (2021)*	*Steady-State (2028)*
Gross Receipts Tax	$16,431	$1,825
Corporate Income Tax	$7,394	$821
Personal Income	$40,803	$3,914
Section 30 Revenue	$21,798	$33,530
Totals	**$86,426**	**$40,090**

Figure 4.1.15-4 compares total GovGuam tax revenue (associated with personal and corporate income, Gross Receipts Tax, and Section 30 revenues) with and without the proposed action. In 2021, tax revenue impacts would be highest, tax revenues with the proposed action are 10.6% higher than they otherwise would have been, without the project. The first year of steady-state operations, 2028, the difference declines to 4.3% - representing a beneficial impact at the maximum and during the steady-state period. The beneficial impact to GovGuam revenues would increase the capacity of GovGuam to provide public services to Guam residents as well as improve GovGuam's ability to service debt and finance infrastructure projects.

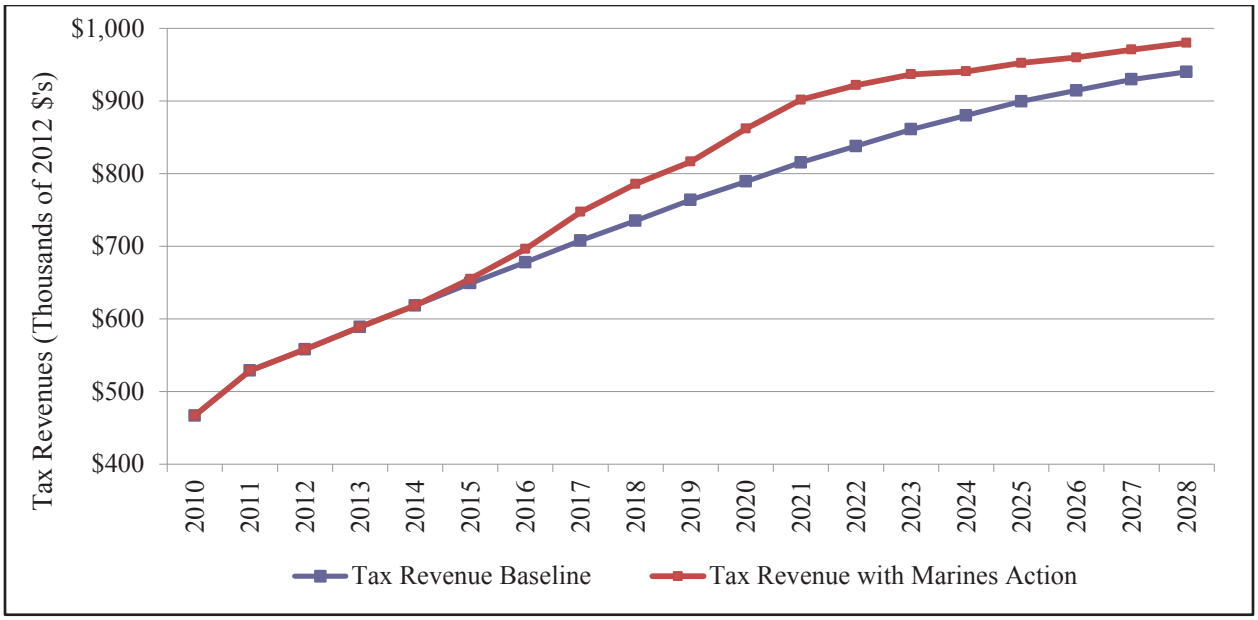


Figure 4.1.15-4. GovGuam Tax Revenues with and without the Proposed Action

Civilian Housing Demand

Table 4.1.15-10 indicates that the peak annual civilian demand for new housing units would occur in 2021, when there would be a need for 770 new units. The annual demand for new housing units would fall to 285 units by 2028.

Figure 4.1.15-5 compares total housing demand on Guam with and without the proposed action. At the 2021 maximum, housing demand with the proposed action is 1.2% higher than it otherwise would have been without the project. At 2028, the difference declines to 0.4%. There would not be a significant impact related to civilian housing demand because there would not be a substantial change to baseline conditions.

Table 4.1.15-10. Demand for New Civilian Housing Units from the Proposed Action

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*
Direct Construction Impact	26	168	342	455	383	325	399	374	294	190	92	7	0	0
Indirect/Induced Construction Impact	16	56	126	159	157	166	204	193	141	88	48	18	3	0
Total Construction Impact	**43**	**224**	**468**	**614**	**539**	**491**	**603**	**567**	**435**	**278**	**139**	**25**	**3**	**0**
Direct Operations Impact	2	3	19	38	56	75	94	113	131	150	169	169	169	169
Indirect/Induced Operations Impact	7	9	10	11	19	64	73	75	94	96	109	113	113	116
Total Operations Impact	**8**	**11**	**29**	**49**	**75**	**139**	**167**	**188**	**225**	**246**	**278**	**282**	**282**	**285**
Combined Direct Impact	**28**	**170**	**361**	**493**	**439**	**400**	**493**	**487**	**425**	**340**	**261**	**176**	**169**	**169**
Combined Indirect Impact	**23**	**65**	**136**	**170**	**176**	**230**	**277**	**268**	**235**	**184**	**157**	**131**	**117**	**116**
Combined Total Impact	**51**	**235**	**497**	**663**	**615**	**630**	**770**	**755**	**660**	**524**	**417**	**307**	**286**	**285**

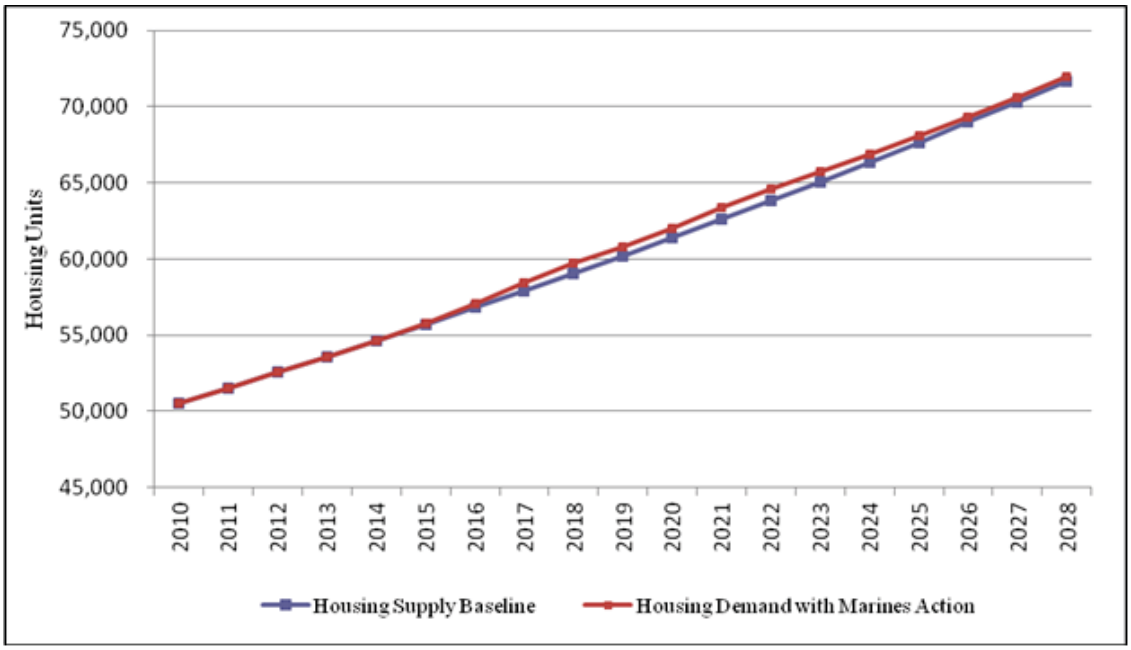


Figure 4.1.15-5. Housing Demand with and without the Proposed Action

Gross Island Product

Table 4.1.15-11 shows the combined total impact on GIP would be $635 million in 2021, declining to a stable figure of $75 million beginning in 2028 as the steady-state operational phase begins. The primary driver of GIP impacts in 2021 would be DoD construction activity, while during the steady-state period GIP impacts would be primarily driven by Marine Corps operational expenditures.

Figure 4.1.15-6 compares Guam's GIP with and without the proposed action. At maximum in 2021, GIP with the proposed action is 10.2% higher than otherwise would have occurred without implementation of the proposed action. At 2028, the difference declines to 1%. There would be a beneficial impact related to GIP at maximum and a smaller beneficial impact during the steady-state period.

Table 4.1.15-11. Impact on GIP (Millions of 2012 $s)

	2015	*2016*	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*
Direct Construction Impact	$41	$144	$285	$408	$391	$370	$428	$411	$320	$216	$122	$46	$8	$0
Indirect Construction Impact	$13	$45	$100	$127	$125	$131	$160	$151	$111	$69	$38	$14	$3	$0
Total Construction Impact	**$54**	**$190**	**$385**	**$535**	**$516**	**$501**	**$587**	**$562**	**$430**	**$285**	**$159**	**$61**	**$11**	**$0**
Direct Operations Impact	$3	$3	$4	$3	$5	$13	$15	$15	$19	$19	$22	$23	$23	$24
Indirect Operations Impact	$2	$2	$4	$5	$8	$28	$32	$33	$42	$43	$49	$50	$50	$51
Total Operations Impact	**$4**	**$6**	**$7**	**$8**	**$13**	**$41**	**$47**	**$49**	**$60**	**$62**	**$71**	**$73**	**$73**	**$75**
Combined Direct Impact	**$43**	**$148**	**$289**	**$412**	**$396**	**$383**	**$443**	**$426**	**$338**	**$235**	**$143**	**$69**	**$31**	**$24**
Combined Indirect Impact	**$15**	**$48**	**$103**	**$131**	**$133**	**$159**	**$192**	**$184**	**$152**	**$112**	**$86**	**$65**	**$53**	**$51**
Combined Total Impact	**$58**	**$195**	**$392**	**$543**	**$529**	**$542**	**$635**	**$610**	**$491**	**$347**	**$230**	**$134**	**$84**	**$75**

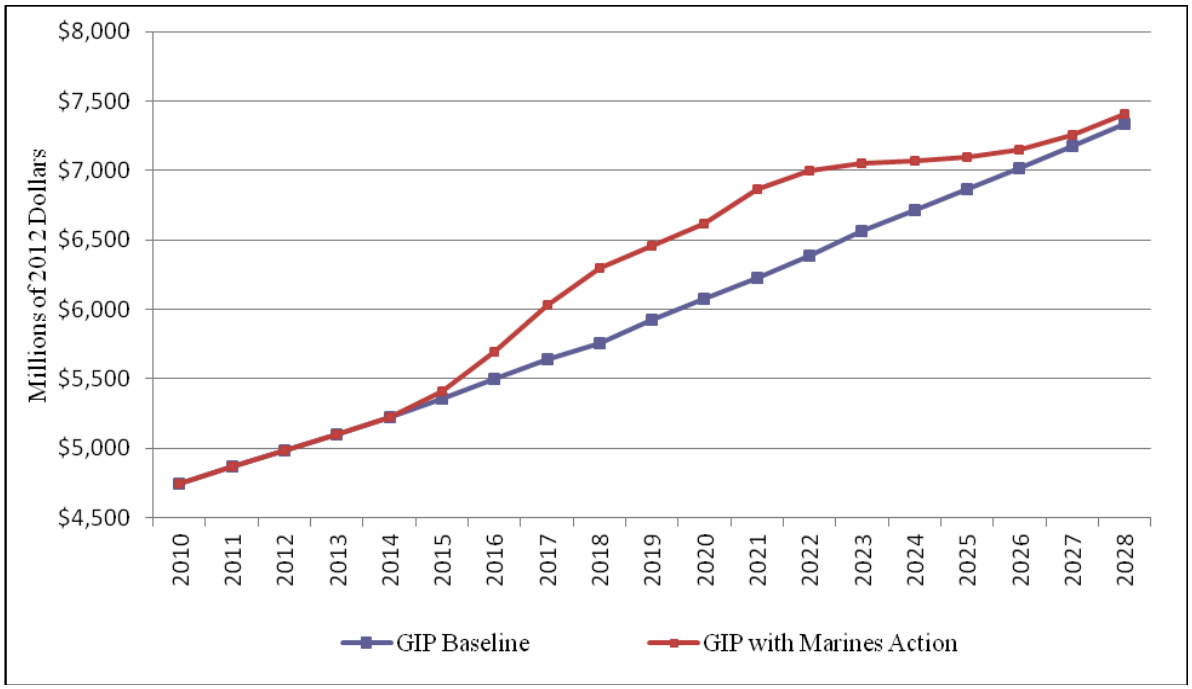


Figure 4.1.15-6. Guam GIP with and without the Proposed Action

Utility Rates

Power. The revised estimated power demand increase including all DoD current and future plans, induced civilian growth, construction workforce, and "organic" civilian growth (per U.S. Census Bureau 2010 forecasts) could be handled by current GPA generating capacity. DoD transmission and distribution system upgrades would likely be required. These upgrades would be paid for by the DoD. Since GPA would not have to fund major system upgrades, the potential effects on ratepayers should be minimal.

Water. Expanded DoD water facilities are proposed to be operated separately from the system operated by GWA and, therefore, no impacts to Guam rate payers are expected from use by DoD facilities. However, current water customers, civilian military workers, induced civilian growth, and other direct and indirect populations related to the proposed action would be impacted, as existing GWA requirements may involve some capital improvements. The water demand from these sources would not be substantial compared to the entire system. DoD supports the GWRDG, whose goals include the management of the NGLA and the GWA and DoD water systems. The results of this cooperative effort should provide mitigation to operational problems with those systems and the water supply from the NGLA. In addition, the FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. Furthermore, Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended. These initiatives should help eliminate the need for any rate increases from the direct and indirect impacts from the proposed relocation. It is possible that the identification of various funding sources (e.g., federal) could beneficially influence any potential rate increases that might otherwise be charged to rate paying customers on Guam.

Wastewater. Upgrades to treatment at the Northern District and Agaña WWTPs and sewer collection system improvements are required whether or not the Marines relocate. These projects could have a significant impact to rate payers. The DoD would assist GWA in identifying funding for necessary upgrades, as indicated in Section 4.1.14, Utilities, and above in the *Water* section. It is possible that the identification of various funding sources (e.g., federal) could beneficially influence any potential rate increases that might otherwise be charged to rate paying customers on Guam. Further, the proposed action could alleviate these rate increases by the addition of Marines as new rate paying customers.

There could also be impacts to the GWA wastewater systems in southern Guam that are not used by the DoD but would have to service additional civilian populations from induced growth. These systems are currently in need of maintenance and upgrades, for which funding has been authorized by the Guam Legislature. The added civilian populations under the revised scenarios would be minimal for the southern parts of Guam and would have little impact on these wastewater systems.

Solid Waste. Population increases as a result of the proposed action would increase the level of solid waste service that would need to be provided and the total cost of providing solid waste services. The increased costs, though, would be spread over a larger group of ratepayers. It is possible that as the level of service (LOS) increases that services would become more efficiently operated and rates for individuals would decline or experience a reduction in future increases expected without the proposed action. However, it is more likely that rates would be little changed as a result of the proposed action.

IT/COMM. IT/COMM would be provided within the proposed new Marine Corps cantonment/family housing areas. Basic underground infrastructure would be installed during the construction of these facilities by DoD. The commercial providers would install the necessary cable infrastructure using the DoD installed conduit, manholes, handholes, and connection facilities. These commercially provided on-base IT/COMM services would be paid for directly by the individual users or potentially by the DoD. For instance, the DoD may opt to provide various housing facilities with internet Wi-Fi and television reception as a convenience to transient residents, similar to many hotels. Other areas, such as family housing, may be on a direct customer service arrangement with the commercial providers. With these arrangements, there should be little to no impact to other commercial IT/COMM customers in Guam.

For additional information on the power, water, and other utilities and related services on Guam, see Section 4.1.14.1 in Chapter 4.

Tourism

The tourism industry on Guam could be impacted in a number of ways. In general, impacts to tourism would be considered mixed (partially beneficial and partially adverse) and, overall, less than significant.

During the construction phase, an increase in construction-related business travel would be expected as a result of the proposed action. Compared to the overall number of annual visitor arrivals to Guam - estimated by the Guam Visitors Bureau to be 1.3 million in FY 2012 (Guam Visitors Bureau 2012) - the number of construction-related business visitor arrivals would be expected to be small and thus impacts would be considered less than significant. Also, the possibility of wage increases or loss of labor to higher-paying jobs during the construction phase is a possible outcome, as wages in the construction sector are higher than those in the tourism sector. Impacts to Guam's tourism industry from loss of workforce and/or wage increases are not expected to be drastic and impacts would be considered less than significant. For more detailed information on construction related impacts to tourism, see Section 4.3.8 of the 2010 Final SIAS (2010 Final EIS, Volume 9: Appendix F).

During the operations phase, it is likely that the increase in military personnel would generate more visits from friends and family, as well as more business travel. With an average weighted 2012 hotel occupancy of 75% (Guam Visitors Bureau 2013), the relocation provides an opportunity for new sources of business and diversification of the travel market. Additionally, off-duty military personnel and their families are likely to patronize retail locations and restaurants island-wide, including the central entertainment district of Tumon Bay, and participate in ocean-based tourism. Population increases are also likely to provide expanded markets for tourism support businesses.

Positive effects on ocean-based tourism are counteracted by both the prospect of more conflicts between various activities due to the limited number of calm-water sites and potential conflicts that could arise from increased demand for tie-off buoys. In Hawaii, another island environment where population growth has generated these conflicts, state government has spent a considerable amount of time attempting to mediate conflicts and work out informal or formal rules for assuring equitable access to sites equally attractive to commercial scuba dive groups, motorized boat tours, rental jet-ski users, paragliders, snorkelers, board surfers, body surfers, and swimmers (Hawaii State Department of Business, Economic Development, and Tourism 2004). Such regulatory efforts would eventually be needed on Guam over time as the population of visitors and military and civilian populations grow. However, even though the scale of the military relocation has been greatly reduced, such actions could be required sooner than they otherwise would be. Overall, due to the mixed nature of impacts and the reduction in population impacts compared to the 2010 Final EIS, impacts to tourism during the operational phase would be considered less than significant.

Public Services

The analysis of public services impacts in this SEIS evaluated two types of affected public service agencies. The first type would be those affected by increased service populations. These agencies are found in the education services, health and human services, public safety services, and the judicial branches of the GovGuam.

The second type of agency would be affected by increased development permit applications. They are GovGuam agencies responsible for issuing, monitoring, and enforcing development permits on Guam.

Public Services Agencies Affected by Increased Population

The analysis focused on the following agencies:

- Guam Department of Education (GDoE)
- Guam Community College (GCC)
- University of Guam (UoG)
- Guam Memorial Hospital Authority (GMHA)
- Guam Department of Public Health and Social Services (GDPHSS)
- Guam Behavioral Health and Wellness Center (GBHWC)
- Guam Department of Integrated Services for Individuals with Disabilities (GDISID)
- Guam Police Department (GPD)
- Guam Fire Department (GFD)
- Guam Department of Corrections (GDoC)
- Guam Department of Youth Affairs (GDYA)
- Guam Department of Parks and Recreation (GDPR)
- Guam Public Library System (GPLS)
- Judiciary of Guam (JoG)

The analysis identified the portion of the population associated with the proposed action that would access services from each agency. This number was deemed the agency's service population. The analysis then determined how many additional staff members each agency would require as a result of this growth in service populations in order to maintain current ratios of staff to service population.

Table 4.1.15-12 provides a summary of the increase in service population projected for each public service agency. Service population numbers are expected to reach a temporary maximum in either 2021 or 2023. A long-term steady-state would be reached for all agencies in 2028.

Table 4.1.15-12. Summary of Projected Increases in Public Agency Service Populations

Agency	*Impact*[1]	
	Maximum	***Steady-State***
GDoE	562	268
GCC	55	39
UoG	99	70
GMHA	5,137	895
GDPHSS	5,137	895
GBHWC	1,934	337
GDISID	1,934	337
GPD	9.585	7,412
GFD	5,285	1,112
GDoC	30	26
GDYA	562	268
GDPR	9,585	7,412
GPLS	9,585	7,412
JoG	9,585	7,412

Note: [1]Numbers represent projected increase in service population that would be generated by the proposed action for each public services agency.

Table 4.1.15-13 shows a summary of the increase in number of staff that would be required by GovGuam public services agencies to meet the increased demand from the additional service populations and building development that would be generated by the proposed action. At maximum, all categories of public services agencies combined would require an estimated 185 additional employees, an increase of 3.6% over baseline staffing levels. The maximum increase in staffing levels would be temporary, lasting from approximately 2021 through 2023. At steady-state, GovGuam agencies would require an additional 66 staff, an increase of 1.3% over baseline levels. These staffing level impacts would be dramatically smaller than those identified in the 2010 Final EIS because of substantially reduced increases in the agency service populations and building development.

Table 4.1.15-13. Summary of Estimated Increases in Public Services Agency Key Staffing Requirements

Agency	*Baseline Staffing*	*Impact*			
		Max	*Max % Increase*	*Steady-State*	*Steady-State % Increase*
Agencies Affected by Population Growth					
Public Education Agencies	2,641	49.1	1.9%	25	0.9%
Public Health and Human Services	1,140	38.4	3.3%	7	0.6%
Public Safety	820	40.2	4.9%	27	3.3%
JoG, GDPR, GPLS, Dept. of Administration, and Customs and Quarantine	322	29.1	9.0%	3	0.9%
Agencies Affected by Development					
Growth Permitting and Regulatory	154	27.9	18.2%	4	2.6%
Agencies Affected by Population Growth and Development Total	**5,077**	**185**	**3.6%**	**66**	**1.3%**

The JoG and other selected agencies (GDPR, GPLS, Department of Administration, and Guam Customs and Quarantine) would experience the largest impact of any of the groups on a percentage basis, and would require a maximum of 29 additional staff (spread over the five agencies) for a period of a few years. At steady-state, these agencies would require only three additional staff above baseline staffing, an increase of 2.6%. Public safety agencies (GPD, GFD, GDoC, and GDYA) would require a maximum of 40 additional staff, an increase of 4.9% over baseline levels for the relatively short construction period. At steady-state, over the long-term, 27 additional staff would be required for the four agencies (an increase of 3.3% over baseline levels). Public health and human service agencies would require a maximum of 48 staff during construction and only seven additional staff in long-term steady-state (a 0.6% increase over baseline). Public education agencies as a group would require 49 additional staff for a short period of a few years and 25 additional staff in the longer term steady-state.

From a broad perspective, looking at the entire group of GovGuam public services agencies overall, impacts would be considered significant in the short-term and less than significant in the long-term steady-state. While the total number of additional staff required during the relatively short construction phase may appear manageable (representing only a 3.6% increase over baseline staffing), other factors including existing shortfalls in staffing and deficiencies in facilities and equipment were considered when determining significance. Also, while additional tax revenues to GovGuam associated with the proposed action would compensate for additional costs that would be incurred, and ample time should be available to plan for short-term staff increases, GovGuam agencies may still face challenges.

In the longer-term steady-state, impacts to public services agencies as a group would be considered less than significant. An increase of 66 staff would be required among all GovGuam agencies that were assessed in order to maintain existing staffing and LOS needed to service population ratios (an increase of 1.3%). Also, as steady-state impacts would occur later and require fewer additional staff than earlier years, it would be expected that agencies would have adequate time and knowledge to plan for steady-state requirements, the cost of which would be covered by increased GovGuam tax revenues.

Some agency subgroups (based on service categories) would be significantly impacted while others would not. Impacts to public education agencies would be less than significant, requiring a maximum of 49 additional staff spread among all GDoE schools (elementary, middle, and high schools), UoG, and GCC (an increase of 1.9%). While difficulties in hiring and retaining staff at public education institutions has been noted by public education agencies, it is anticipated that military spouses who would move to Guam in association with the proposed action could potentially add to the available supply of qualified teachers.

Public health and human services agencies as a group would require 38 additional staff, most of whom (29) would need to be nurses and allied health professionals at GMHA. Given the existing shortfall of nurses on Guam these additional requirements would be considered significant in the short-term. Services provided by GMHA and other health service providers would be more closely tied to construction workers than to military personnel and dependents so, as the proposed action would reach a steady-state, requirements on health service agencies would decline and be less than significant in the long-term.

Because of existing deficits in staff, facilities, and equipment, impacts to JoG, GDPR, GPLS, Department of Administration, and Guam Customs and Quarantine would be considered significant during both the short-term construction phase and the long-term steady-state period.

Potential mitigation measures to address significant impacts to all public services agencies affected by increased population would be as follows:

- The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded. See Section 2.9 for further discussion on the CMCC. Such support may include providing project-related employment and population forecasts, participating in the identification of shortfalls in Guam public services, and assisting in the identification of federal programs and funding sources that may help GovGuam to address shortfalls.
- The DoD would continue to support existing programs that contribute and/or donate excess equipment to local agencies.

Public Education

This section analyzes impacts on public primary and secondary schools run by GDoE and on the higher education institutions GCC and UoG, including quantitative analysis of impacts on:

- Student population numbers
- GDoE teacher requirements
- GCC and UoG non-adjunct faculty requirements

Guam Department of Education. Table 4.1.15-14 provides an overview of impacts on GDoE student populations during the action's maximum impact year and steady-state years.

Table 4.1.15-14. GDoE Student Population Impacts Summary

Agency	*Current Service Population*	*Max Year*	*Max Year Additional Service Population*	*Max Year Percentage Increase*	*Steady State Additional Service Population*	*Steady State Requirements Percentage Increase*
GDoE Elementary	14,454	2021	275	1.9%	131	0.9%
GDoE Middle	7,212	2021	119	1.6%	57	0.7%
GDoE High	9,415	2021	168	1.7%	80	0.8%
Totals	**31,081**		**562**	**1.8%**	**268**	**0.8%**

Table 4.1.15-15 provides an overview of impacts on GDoE staffing during the action's maximum impact year and steady-state years.

Table 4.1.15-15. Primary and Secondary Education Teacher Requirements Impacts Summary

Agency	*Current Teachers*	*Year*	*Max Year Teacher Requirements*	*Max Year Percentage Increase*	*Steady State Teacher Requirements*	*Steady State Requirements Percentage Increase*
GDoE Elementary	1,245	2021	24	1.9%	11	0.8%
GDoE Middle	557	2021	9	1.6%	4	0.7%
GDoE High	572	2021	10	1.7%	5	0.8%
Totals	**2,374**		**43**	**1.8%**	**20**	**0.8%**

Guam Community College and University of Guam. Table 4.1.15-16 and Table 4.1.15-17 provide overviews of impacts on GCC and UoG student populations and non-adjunct faculty requirements during the action's maximum impact year and steady-state years.

Table 4.1.15-16. Higher Education Student Population Impacts Summary

Agency	*Current Service Population*	*Max Year*	*Max Year Additional Service Population*	*Max Year Percentage Increase*	*Steady State Additional Service Population*	*Steady State Requirements Percentage Increase*
GCC	3,445	2023	55	1.6%	39	1.1%
UoG	3,639	2023	99	2.7%	70	1.9%
Totals	**7,084**		**154**	**2.2%**	**109**	**1.5%**

Table 4.1.15-17. Higher Education Faculty Requirement Impacts Summary

Agency	*Current Non-adjunct Faculty*	*Max Year*	*Max Year Non-adjunct Faculty Requirements*	*Max Year Percentage Increase*	*Steady State Non-adjunct Faculty Requirements*	*Steady State Requirements Percentage Increase*
GCC	69	2023	1.1	1.5%	0.8	1.1%
UoG	198	2023	5	2.5%	4	2.0%
Totals	**267**		**6.1**	**2.3%**	**4.8**	**1.8%**

Impacts to Guam public education agencies were determined to be less than significant. However, because potential mitigation measures described above may identify potential deficiencies at public service agencies in general, they may serve to benefit Guam public education agencies.

Public Health and Human Services

This section analyzes impact on the following GovGuam public health and human service agencies:

- GMHA
- GDPHSS
- GBHWC
- GDISID

Quantitative impact analysis is provided on:

- Service population numbers
- Key staffing requirements

Table 4.1.15-18 provides an overview of impacts on GMHA, GDPHSS, GBHWC and GDISID service populations during the action's maximum impact year and steady-state years.

Table 4.1.15-18. Impact on Public Health and Human Services, Service Population Summary

Agency	*Current Service Population*	*Max Year*	*Max Year Additional Service Population*	*Max Year Percentage Increase*	*Steady State Additional Service Population*	*Steady State Requirements Percentage Increase*
GMHA	159,358	2021	5,137	3.2%	895	0.5%
GDPHSS	60,000	2021	1,934	3.2%	337	0.6%
GBHWC	60,000	2021	1,934	3.2%	337	0.6%
GDISID	159,358	2021	5,137	3.2%	895	0.5%

Table 4.1.15-19 provides an overview of impacts on various public health and human services agency staffing requirements during the action's maximum impact year and steady-state years.

Table 4.1.15-19. Public Health and Human Services Impact Summary

Agency and Staffing Type	*Current Staffing*	*Max Year*	*Max Year Staffing Requirements*	*Max Year Percentage Increase*	*Steady State Staffing Requirements*	*Steady State Staffing Requirements Percentage Increase*
GMHA Physicians	92	2021	3	3.2%	1	1%
GMHA Nurses and Allied Health Professionals	819	2021	29	3.5%	5	0.6%
GDPHSS - Primary Care Medical Providers and Nursing Staff	10	2021	0.3	3%	0.1	1%
GDPHSS - Bureau of Communicable Disease Control Communicable Disease Prevention Professionals	25	2021	0.3	1.2%	0.1	0.4%
GDPHSS - Bureau of Family Health and Nursing Services Nurses	17	2021	0.5	2.9%	0.1	0.5%

Table 4.1.15-19. Public Health and Human Services Impact Summary

Agency and Staffing Type	*Current Staffing*	*Max Year*	*Max Year Staffing Requirements*	*Max Year Percentage Increase*	*Steady State Staffing Requirements*	*Steady State Staffing Requirements Percentage Increase*
GBHWC - Mental Health Professionals	169	2021	5	2.9%	1	0.5%
GDISID Social Workers and Counselors	8	2021	0.3	3.8%	0	0%
Total	**1,140**		**38.4**	**3.4%**	**7.3**	**0.6%**

Notes: There are a wide variety of medical providers captured in the GDPHSS estimate, reflecting the diverse services provided by GDPHSS. They include Obstetrician/Gynecologist (Obstetrics and Gynecology), family practitioners, internists, pediatricians, nurse practitioners and certified nurse midwives.

Impacts to public health and human services agencies would be significant in the short-term, primarily during the period when large numbers of project-related off-island construction workers would be on Guam. While each agency analyzed would be impacted, the vast majority of additional staff required would be nurses and allied health professionals. Nurses are in high demand and there is an existing deficit on Guam. An Allied Health Building, where a program directed towards a practical nursing certificate is offered, was recently constructed on the GCC campus. The practical nursing program has proven successful so far and the potential for new qualified nurses on Guam is on the rise. Potential mitigation measures that may help secure funding for additional staff and/or facilities are identified above.

Public Safety

This section analyzes impact on the following public safety agencies:

- GPD
- GFD
- GDoC
- GDYA

Quantitative impact analysis is provided on:

- Service population numbers
- Key staffing requirements

Table 4.1.15-20 provides an overview of impacts on GPD, GFD, GDoC, and GDYA service populations during the action's maximum impact year and steady-state years.

Table 4.1.15-20. Impact on Public Safety Service Population Summary

Agency	*Current Service Population*	*Max Year*	*Max Year Additional Service Population*	*Max Year Percentage Increase*	*Steady State Additional Service Population*	*Steady State Requirements Percentage Increase*
GPD	159,358	2021	9,585	6%	7,412	4.6%
GFD	145,890	2021	5,258	3.6%	1,112	0.7%
GDoC	544	2023	30	5.5%	26	4.8%
GDYA	10,470	2021	562	5.3%	268	2.5%
Total	**316,262**		**15,435**	**4.9%**	**8,818**	**2.8%**

Table 4.1.15-21 provides an overview impacts on various public safety services agency staffing requirements during the action's maximum impact year and steady-state years.

Table 4.1.15-21. Public Safety Services Staffing Impacts Summary

Agency and Staffing Type	*Current Staffing*	*Max Year*	*Max Year Staffing Requirements*	*Max Year Percentage Increase*	*Steady State Staffing Requirements*	*Steady State Staffing Requirements Percentage Increase*
GPD - Police Officers	307	2023	19	6.2%	14	4.6%
GFD - Firefighters	258	2021	9	3.5%	2	0.8%
GDoC - Custody and Security Personnel	207	2023	11	5.3%	10	4.8%
GDYA - Youth Service Professionals	48	2021	1.2	2.5%	0.6	1.25%
Total	**625**		**29.2**	**4.7%**	**19.6**	**3.1%**

Impacts to public safety agencies were determined to be significant in both the short-term and long-term. The number of crimes may increase in proportion to increases in population, thereby necessitating additional police officers and custody and control personnel (combined, 30 at maximum and 24 at steady-state). Also, GPD has identified existing difficulties in maintaining adequate staff as well as an existing shortfall in equipment (most notably patrol cars). Potential mitigation measures that may help secure funding for additional staff and/or facilities are identified above.

Judiciary of Guam and Selected Agencies Driven by Population Growth

This section analyzes impacts to the JoG (a branch of Government, not an executive agency), GDPR, and GPLS. Additionally, in comments on the Draft SEIS, two GovGuam agencies (the Guam Department of Administration and the Guam Customs and Quarantine Agency) identified estimated maximum year staffing impacts (estimated steady-state requirements were not identified). These estimates of staffing impacts have been added to the assessment of impacts to Guam public service agencies.

Quantitative impact analysis is provided on:

- Service population numbers
- Key staffing requirements

Impacts discussed are independent of any needs that may result from non-project related general population growth. The results presented in this section indicate that there would not be a substantial number of new staff required for JoG and selected other service agencies.

Table 4.1.15.22 provides an overview of the proposed action's impacts on for JoG and selected other service agencies.

Table 4.1.15-22. JoG and Selected Agencies Driven by Population Growth

Agency and Staffing Type	*Current Key Staffing*	*Max Year*	*Max Year Key Staffing Requirements*	*Max Year Percentage Increase*	*Steady State Key Staffing Requirements*	*Steady State Requirements Percentage Increase*
GDPR - General Staff	30	2023	1.8	6%	1.4	4.7%
GPLS - General Staff	30	2023	1.8	6%	1.4	4.7%
Judiciary - Judges	9	2023	0.5	5.6%	0.4	4.4%
Department of Administration	114	-	16	14%	-	-
Customs and Quarantine	139	-	9	6.5%	-	-
Total	**322**		**29**	**9%**	**3.2**	**4.6%**

Note: Analysis was not conducted for Department of Administration and Guam Customs and Quarantine. Information was provided in the Draft SEIS public comment process.

While there would not be a substantial number of new staff required, impacts to JoG and selected agencies were determined to be significant in both the short-term and long-term because JoG has identified existing deficiencies in both staff and facilities. Potential mitigation measures that may help secure funding for additional staff and/or facilities are identified above.

Public Services Agencies Affected by Development

Analysis was also conducted for agencies that would be influenced by increased development that would be directly and indirectly associated with the proposed action. These agencies work to regulate development through the permitting process and are expected to see increase in permit requests. These agencies included:

- GDPW, Building Permits and Inspection
- Guam Department of Land Management
- GEPA
- Guam Coastal Management Program, within GBSP
- GPA
- GWA
- GFD, Permitting Staff
- SHPO, within the GDPR
- Guam Division of Environmental Health (within the GDPHSS)
- Guam Alien Labor Processing and Certification Division within the Guam Department of Labor

Analysis of the proposed action indicated the approximate number of construction and development permits that would be needed to complete the planned activities. It was then determined how many permitting staff members each agency would require in the face of this growth in permitting applications and inspections.

Table 4.1.15-23 shows current staffing, projected staffing impact, and the projected percentage increase in staffing for permitting and regulatory agencies. Since different permitting agencies serve various functions, some of which are not solely driven by population change, the maximum impact year of

analysis varies between agencies. Unlike the previously described services, the permitting work of these agencies would be driven by increases in permit applications before and during the process of development growth on Guam (rather than population increases). While not all permit applications are of similar scope (permits for larger projects require more labor than permits for smaller projects), the mix of large and small permits for each forecast year is not accounted for due to lack of information. The mix of large and small permits applications for the year 2012 (when data were collected) is incorporated into the impact analysis.

Table 4.1.15-23. Summary of Key Staffing Requirements for Public Services Agencies Affected by Development

	Baseline Staffing	*Impacts*			
		Maximum	*Maximum Impact %*	*Steady-State*	*Steady-State Impact %*
GDPW	6	0.8	13%	0.1	1.7%
Guam Department of Land Management	5	1.7	34%	1.4	28.0%
GEPA	48	9.7	20%	0.7	1.5%
Guam Coastal Management Program	6	0.9	15%	0.6	10.0%
GPA	6	0.7	12%	0.1	1.7%
GWA	5	0.9	18%	0.1	2.0%
GFD	14	0.8	6%	0.3	2.1%
Guam Division of Environmental Health	11	0.8	7%	0.5	4.5%
SHPO	6	0.6	10%	0.1	1.7%
Guam Alien Labor Processing & Certification Division	5	11	220%	0	0.0%
Total	**112**	**28**	**25%**	**4**	**3.6%**

Note: [1]Numbers represent projected increase in key staff for each permitting agency that would be required to maintain current levels of service.

(Note that impacts to GFD, GDPR, and GDPHSS were also addressed in the prior impact section. This section analyzes only the impact on their permitting functions, which represent only a small percentage of their overall functions).

The analysis for public services agencies affected by development indicates that impacts would be significant in the short-term and less than significant during the steady-state period. During the short period when impacts would be greatest, growth permitting agencies would require an increase in staff of 25%, which is a large proportional increase. The determination of significance is also based on the importance of meeting these staffing requirements - a lack of staffing at permitting agencies could hinder development both directly and indirectly associated with the proposed action, which could serve to block or delay the economic benefits projected to accompany the proposed action. Inadequate staffing at the ALPCD, for instance, could slow the processing of H2-B worker visas, and the ALPCD has indicated that staffing levels are already at capacity and are not sufficient to handle any influx related to the proposed action. Without H2-B workers, both project-related and non-project related development would likely be slowed due to a shortage of skilled construction workers. In the longer-term steady-state, impacts to permitting agencies would be less than significant. While the increased staff requirement would represent an appreciable proportion of baseline staffing (3.6%), only four additional staff would be required. Given the time agencies would have to plan for this increase and additional tax revenues that would be associated with the proposed action, the 3.6% increase would be considered less than significant.

Guam Department of Land Management. The impact from permits would be greatest in 2019, when 113 permits would be requested, and would decline to 14 permits by 2028. New staff required would be largest in 2019 at 1.7 FTEs and would drop to 1.4 FTEs at 2028. New staff for Guam Department of Land Management would be primarily related to increased demands from land use commission hearings.

Guam Environmental Protection Agency. The proposed action's impact would be largest in 2019 with 271 additional GEPA permit applications, requiring an additional 9.7 FTEs. In the year 2028, the impact drops to an additional 14 permits requiring an additional 0.7 FTEs.

Guam Coastal Management Program. Impacts on Guam Coastal Management Program permits would be largest in 2021 at 16 and decline to 5 at 2028. New staff required for monitoring and enforcement makes up a large portion of the combined total employment. The impact to staffing would be largest in 2021 at 0.9 FTEs and would drop to 0.6 FTEs by 2028.

Guam Power Authority. The proposed action's impact would be largest at 108 additional GPA permit applications in 2019, requiring an additional 1.1 FTE employees. At 2027, the impact drops to an additional 8 permits, requiring 0.1 additional FTE worker.

Guam Water Authority. The proposed action's impact would be largest at 55 additional GWA permit applications in 2019 and 2020, requiring an additional 0.9 FTEs. At 2027 and 2028, the impact drops to an additional 6 permits, requiring 0.1 new FTE.

Guam Fire Department. The proposed action's impact would be largest at an additional 69 GFD permit applications in 2019, requiring an additional 0.7 FTE employees. At 2027 and 2028, the impact drops to 8 additional permits, requiring 0.3 FTE.

Guam Department of Public Health and Social Services - Division of Environmental Health. Impacts on Division of Environmental Health permits would be largest at 45 in 2019 and decline to 5 by 2027. New staff required for monitoring and enforcement, makes up most of the combined total employment impact, be largest in 2020 at 0.8 FTEs and dropping to 0.5 FTEs by 2026.

Guam Department of Parks and Recreation-Historic Preservation Office. The proposed action's impact would be largest at 140 additional SHPO permit applications in 2019, requiring an additional 0.6 FTEs. At 2028, the impact drops to an additional 11 permits, requiring 0.1 FTE.

Guam Department of Labor-Alien Labor Processing and Certification Division. The proposed action's impact would be largest at 2,291 additional Alien Labor Processing and Certification Division applications in 2018, requiring an additional 11 FTEs. This impact drops to zero FTE beginning in 2026.

Table 4.1.15-24 shows annual costs associated with additional key professional staff at Guam public services agencies and revenues that would be generated by the proposed action. During both the maximum year (2021) and the steady-state years (beginning in 2028) revenues would exceed costs. Additional costs would likely be incurred in association with support staff; however, even considering costs associated with support staff, revenues would be anticipated to exceed costs. Some additional information on support staff is provided in the SIAS (Appendix D)

Table 4.1.15-24. Costs and Revenues Impact of Additional Key Professional Staff at Guam Government Agencies

Agency	*Increase in Key Professional Staff*		*Average Employee Salary*	*Cost Impacts From New Employee Salaries*		*Other Associated Cost Impacts (i.e. Rent, Office Supplies)*	
	Maximum (2021)	*Steady-State (2028)*		*Maximum (2021)*	*Steady-State (2028)*	*Maximum (2021)*	*Steady-State (2028)*
Guam Department of Education (GDoE)	43	20	$41,090-$42,090	$1,791,670	$833,200	$1,149,533	$534,667
Guam Community College (GCC)	1.1	0.8	$53,368	$58,705	$42,694	$29,407	$21,387
University of Guam (UoG)	5	4	$53,368	$266,840	$213,472	$133,667	$106,933
Guam Memorial Hospital Authority (GMHA) - Physicians	3	1	$203,540	$610,620	$203,540	$9,696	$3,232
Guam Memorial Hospital Authority (GMHA) - Nurses and Allied Health Professionals	29	5	$52,450	$1,523,660	$262,700	$93,728	$16,160
Guam Department of Public Health and Social Services (GDPHSS)	1.1	0.3	$22,471-$36,414	$35,873	$9,530	$3,555	$970
Guam Behavioral Health and Wellness Center (GBHWC)	5	1	$32,228	$161,140	$32,228	$16,160	$3,232
Guam Department of Integrated Services for Individuals with Disabilities (GDISID)	0.3	0	$35,751	$10,725	$0	$970	$0
Guam Police Department (GPD)	19	14	$31,816	$604,512	$445,430	$86,949	$64,068
Guam Fire Department (GFD)	9	2	$41,922	$377,294	$83,843	$41,187	$9,153
Guam Department of Corrections (GDoC)	11	10	$39,149	$430,639	$391,490	$50,339	$45,763
Guam Department of Youth Affairs (GDYA)	1.2	0.6	$37,034	$44,441	$22,221	$6,384	$3,192
Guam Department of Parks and Recreation (GDPR)	1.8	1.4	$50,717	$91,291	$71,004	$9,575	$7,448
Guam Public Library System (GPLS)	1.8	1.4	$23,808	$42,854	$33,331	$8,237	$6,407
Judiciary of Guam (JoG)	0.5	0.4	$113,666	$56,833	$45,466	$2,660	$2,128
Department of Administration	16	-	$46,680	$746,880	-	$73,216	-
Guam Customs and Quarantine	9	-	$32,360	$291,240	-	$41,184	-
Guam Department of Public Works (GDPW)	0.8	0.1	$41,172	$32,938	$4,117	$4,256	$532
Guam Department of Land Management	1.7	1.4	$38,716	$65,817	$54,202	$9,043	$7,448
Guam Environmental Protection Agency (GEPA)	9.7	0.7	$40,150	$389,455	$28,105	$51,601	$3,724
Guam Coastal Management Program	0.9	0.6	$49,364	$44,428	$29,618	$4,788	$3,192
Guam Power Authority (GPA)	0.7	0.1	$74,450	$52,115	$7,445	$3,724	$532

Agency	*Increase in Key Professional Staff*		*Average Employee Salary*	*Cost Impacts From New Employee Salaries*		*Other Associated Cost Impacts (i.e. Rent, Office Supplies)*	
	Maximum (2021)	*Steady-State (2028)*		*Maximum (2021)*	*Steady-State (2028)*	*Maximum (2021)*	*Steady-State (2028)*
Guam Water Authority (GWA)	0.9	0.1	$60,420	$54,378	$6,042	$4,788	$532
GFD - Permitting	0.8	0.3	$40,383	$32,306	$12,115	$4,256	$1,596
Guam Division of Environmental Health	0.8	0.5	$41,172	$32,938	$20,586	$4,256	$2,660
Guam - SHPO	0.6	0.1	$36,984	$22,190	$3,698	$3,192	$532
Guam Alien Labor Processing & Certification Division	11	0	$27,244	$299,684	$0	$50,339	$0
Totals	**184.7**	**65.8**	**--**	**$8,171,465**	**$2,856,078**	**$1,896,688**	**$845,484**
	Maximum (2021) (Thousands of 2012 $s)			***Steady-State (2028) (Thousands of 2012 $s)***			
Projected Costs	**$10,068**			**$3,702**			
Section 30 Revenue	***$21,798***			***$33,530***			
Tax Revenue (personal income tax, gross receipts tax, and corporate income tax)	***$64,628***			***$6,560***			
Total Projected Revenue	**$86,426**			**$40,090**			

Potential mitigation measures to address significant impacts to public services agencies affected by development would be as follows:

- The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded. See Section 2.9 for further discussion on the CMCC. Such support may include providing project-related employment and population forecasts, participating in the identification of shortfalls in Guam public services, and assisting in the identification of federal programs and funding sources that would help GovGuam to address shortfalls.
- The DoD would continue to support existing programs that contribute and/or donate excess equipment to local agencies.
- In accordance with the 2011 PA, DoD would provide liaison support to the Guam SHPO to assist in processing DoD actions.

Sociocultural Issues

When reviewing sociocultural impacts in this section, it is important to remember that while social issues are not direct impacts that occur at the same time and place as the proposed action, they are indirect impacts of the proposed action that can occur later in time or further in distance.

There is a potential for sociocultural impacts to occur, but the magnitude of the impacts are difficult to predict and could vary substantially based on policy and program choices yet to be made. Sociocultural impacts are inherently qualitative and may also be affected by events yet to occur. For these reasons, and for the purposes of this SEIS, impacts to sociocultural issues are conservatively classified as significant.

Identified impacts include the following:

- *Political and Chamorro issues*. Concerns involving political minoritization would be impacted by the potential increase in non-Chamorro populations due to the relocation, notably during the operational phase. More non-Chamorro and local voters could potentially affect ongoing and future issues as a function of voting. However, while the Marines and adult dependents would likely vote in national elections, most of the relocating Marines would be on Guam for relatively short periods (from approximately 6 months for rotational forces to 2 or 3 years for permanent party forces) and would likely not become deeply engaged in local politics.
- *Crime and Social Order.* In proportion to the increase in population, there would potentially be impacts associated with an increase in the number of crimes (though not necessarily an increase in the crime rate as a function of population) and decreased social order.
- *Community Cohesion*. Chamorros expect people to approach their relationships with the wider society conforming to the philosophy of "respetu" (in the Chamorro language it means respect or veneration). There is potential for social friction due to lack of understanding of, and inability to enact, this concept by military personnel and off-island civilian in-migrants, especially in the initial stages of construction and military personnel coming to Guam.

Potential mitigation measures to address sociocultural issues are as follows:

- In accordance with the 2011 PA, the DoD will conduct orientation briefs for all incoming DoD personnel, their families, and contractors regarding cultural sensitivity in the area. All DoD personnel and contractors working on Guam will receive annual briefings. The DoD will develop the briefing in consultation with the appropriate SHPO and will provide SHPO with a copy of the final briefing materials.
- The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth to address sociocultural issues. See Section 2.9 for further discussion on the CMCC.
- In accordance with the 2011 PA, the $12,000,000 appropriated under the FY 2012 Consolidated Appropriations Act (Public Law No. 112-74) for a Guam Cultural Repository facility remains in place. The appropriation provides funding for a repository for curation of archaeological collections on Guam and to serve as a source of information on Guam history and culture. As directed by the FY 2014 NDAA, the DoD would convene the EAC to consider necessary technical and financial assistance and develop an implementation plan coordinated with EAC federal agencies. This plan must be submitted to the congressional defense committees as part of a reporting requirement that is due no later than the date of issuance of the ROD.

Land Acquisition

There would be no land acquisition impacts associated with Alternative A because there would be no land acquisition required to implement the cantonment/family housing alternatives.

4.1.16 Hazardous Materials and Waste

4.1.16.1 Affected Environment

This section describes the current hazardous materials and waste management practices that differ from those described in the 2010 Final EIS or that apply to areas not included in the 2010 Final EIS. This section also identifies any additional contaminated sites in the proposed construction/development areas that have not already been discussed in the 2010 Final EIS.

The current DoD ROI on Guam for hazardous materials and waste in this section includes the DON properties proposed for development of the cantonment/family housing including Finegayan and Potts Junction, and the areas affected by off-site utilities development and DoD school expansions (see Section 2.4.4.6 in Chapter 2).

Hazardous Materials Management

Routine operations at DoD installations require the storage, use, and handling of a variety of hazardous materials such as paints, solvents adhesives, lubricants and pesticides. Bulk quantities of fuels and other petroleum, oil, and lubricants (POLs) are stored and distributed in aboveground storage tanks and underground storage tanks, pumps, and pipelines to support aircraft, watercraft, vehicle operations, and emergency power generation. The management, storage, shipment and disposal of hazardous materials is managed by Defense Reutilization Marketing Office (DRMO) and via the various plans and policies as described in the 2010 Final EIS (Volume 2, Chapter 17: Hazardous Materials and Waste, Table 17.2-3: Summary of Best Management Practices and Standard Operating Procedures, pages 17-42 to 17-43 and Volume 7, Chapter 2, Overview of Best Management Practices and Potential Mitigation Measures, Table 2.1-1. Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23).

Finegayan

NAVFAC is responsible for overseeing the management of hazardous materials on all DON facilities on Guam. Hazardous materials at Naval Base Guam are stored at a warehouse operated by Joint Environmental Material Management Service. Joint Environmental Material Management Service consolidates hazardous materials for reuse and tracks it through an inventory management program. Unused hazardous materials are returned to Joint Environmental Material Management Service for redistribution or disposal.

Potts Junction

Currently there are no hazardous materials being stored or used at this location. The site is currently undeveloped and unused.

A jet fuel transmission line is located at the Route 3/28 intersection leading to AAFB. A review of aerial photography shows the jet fuel transmission line crossing Route 3 south of the Route 3/3A intersection to the north of Potts Junction where the transmission line enters AAFB. No incidents of contamination are known to be associated with this jet fuel line. There was no visual evidence of soil or groundwater remediation at the area where the transmission line crosses under Route 3, and no groundwater monitoring wells were found on- or off-site. Soil sampling would be required to determine whether the pipeline has affected site conditions.

Hazardous Waste Management

Finegayan

Operations at DoD installations on Guam generate a variety of hazardous waste, including, but not limited to waste of: medical and dental supplies; adhesives; solvents; contaminated absorbents; corrosive liquids; aerosols; pesticides; used POLs; and sludges. In accordance with DoD policies, all facilities must seek to reduce or eliminate hazardous waste generation by implementing BMPs, SOPs, and best available technologies. There are numerous BMPs and SOPs used by DoD to minimize or eliminate the generation of hazardous waste, which are discussed in the 2010 Final EIS (Volume 2, Chapter 17: Hazardous Materials and Waste, Table 17.2-3: Summary of BMPs and SOPs, pages 17-42 to 17-43 and Volume 7, Chapter 2: Overview of Best Management Practices and Mitigation Measures, Table 2.1-1. Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23) and summarized in Chapter 2 of this SEIS. Disposal of hazardous waste generated at DoD facilities on Guam is arranged by DRMO. Specifically, licensed hazardous waste contractors transport and dispose of hazardous waste at permitted facilities. Under this arrangement, DRMO maintains all hazardous waste documentation and ensures that all disposal actions are performed in accordance with pertinent federal, state, and local laws and regulations.

Naval Base Guam is a large quantity generator of hazardous waste, generating over 2,200 pounds (998 kg) of hazardous waste per month. Similar to AAFB, Naval Base Guam maintains a Hazardous Waste Management Plan. This plan applies to all military commands, tenants, homeported and visiting ships, submarines, civil service personnel that may receive, use, store handle, transport recycle or dispose of hazardous waste during the performance of their duties. Hazardous waste accumulation points are designated by the NAVFAC Marianas Environmental Business Line. There are 52 satellite accumulation areas, five 90-day storage areas and one conforming storage facility on Naval Base Guam. The conforming storage facility is located at Building 1790. The facility is permitted to hold up to 300,000 pounds of waste for up to 1 year and is currently operating at 30-40% capacity. Non-recyclable hazardous waste is shipped off island four times per year via DMRO. Recyclable materials are sent to local companies.

As part of the DRMO waste management system, centralized accumulation points and satellite accumulation points are utilized at DoD installations on Guam. The accumulation points often contain a variety of waste, typically stored in 5-gallon (19 liters) pails, 55-gallon (208 liters) drums, and other approved hazardous waste containers. DRMO arranges for the disposal of approximately 594,494 pounds (269,658 kg) of hazardous waste annually from DoD Guam operations. Finegayan currently contains two satellite hazardous waste accumulation sites.

Potts Junction

Currently there is no hazardous waste being stored or generated at this location. The site is currently unused.

Contaminated Sites

The IRP and Military Munitions Response Program (MMRP) focus on cleaning up releases of hazardous substances and MEC that pose risks to the public and/or the environment at active, base realignment and closure, and Formerly Used Defense Sites owned or used by the DoD.

On Guam, DoD facilities have ongoing Defense Environmental Restoration Program site cleanup activities with GEPA and USEPA oversight. The DoD and State/Territorial Memorandum of Agreement established a program where GEPA staff work closely with DoD representatives to discuss and facilitate environmental restoration and clean-up work on Guam.

Finegayan

Installation Restoration Program Sites. There are two IRP sites located on Finegayan. These sites are summarized in Table 4.1.16-1 and depicted in Figure 4.1.16-1. A site investigation was completed for these sites and no risks to human health or ecological receptors were identified. Land use restrictions have been placed on these sites.

Table 4.1.16-1. IRP and Potentially Contaminated Sites on Finegayan

Sites Within Affected Area		
Site Name	***Area (Acres [ha])***	***Status***
Finegayan Landfill No. 1	3 (1)	Active (Land Use Controls)
Finegayan Landfill No. 2	9 (4)	Active (Land Use Controls)

Military Munitions Response Sites. No MMRP sites were identified in the area of Finegayan proposed for development for cantonment/family housing under this Alternative.

Potts Junction

Installation Restoration Program Sites. This site is a former fuel tank farm located adjacent to the south side of Route 9, just north of Chalan Kareta and south of the Route 9/3 intersection and is managed under the facility IRP (Site 80). Recent aerial photos of the site indicate that the site is heavily vegetated with possible remnants of concrete pads. The site was visited in 2009 but was inaccessible and could not be seen from the roadway. It is unknown whether environmental contamination exists on the site. However, no groundwater monitoring wells were observed on- or off-site. This site was recently added to the IR program.

Military Munitions Response Program Sites. No MMRP sites were identified on the Pott's Junction parcel (Figure 4.1.16-1).

Toxic Substances Management

Toxic substances associated with DoD operations on Guam include asbestos-containing material (ACM), lead-based paint (LBP), polychlorinated biphenyls (PCBs), and radon. These substances have been sufficiently defined in the 2010 Final EIS (Volume 2: Chapter 17: Hazardous Materials and Waste, pages 17-9 to 17-11). LBP and PCBs in Guam are taken by licensed transporters and disposed of in permitted landfill facilities in accordance with applicable federal, state, and local laws and regulations. ACM is disposed of at federal facilities on Guam. Disposal contracts specifically prohibit DoD contractors from the import and use of hazardous or toxic substances.

The collection, transportation, and disposal of these toxic substances are arranged by DRMO.

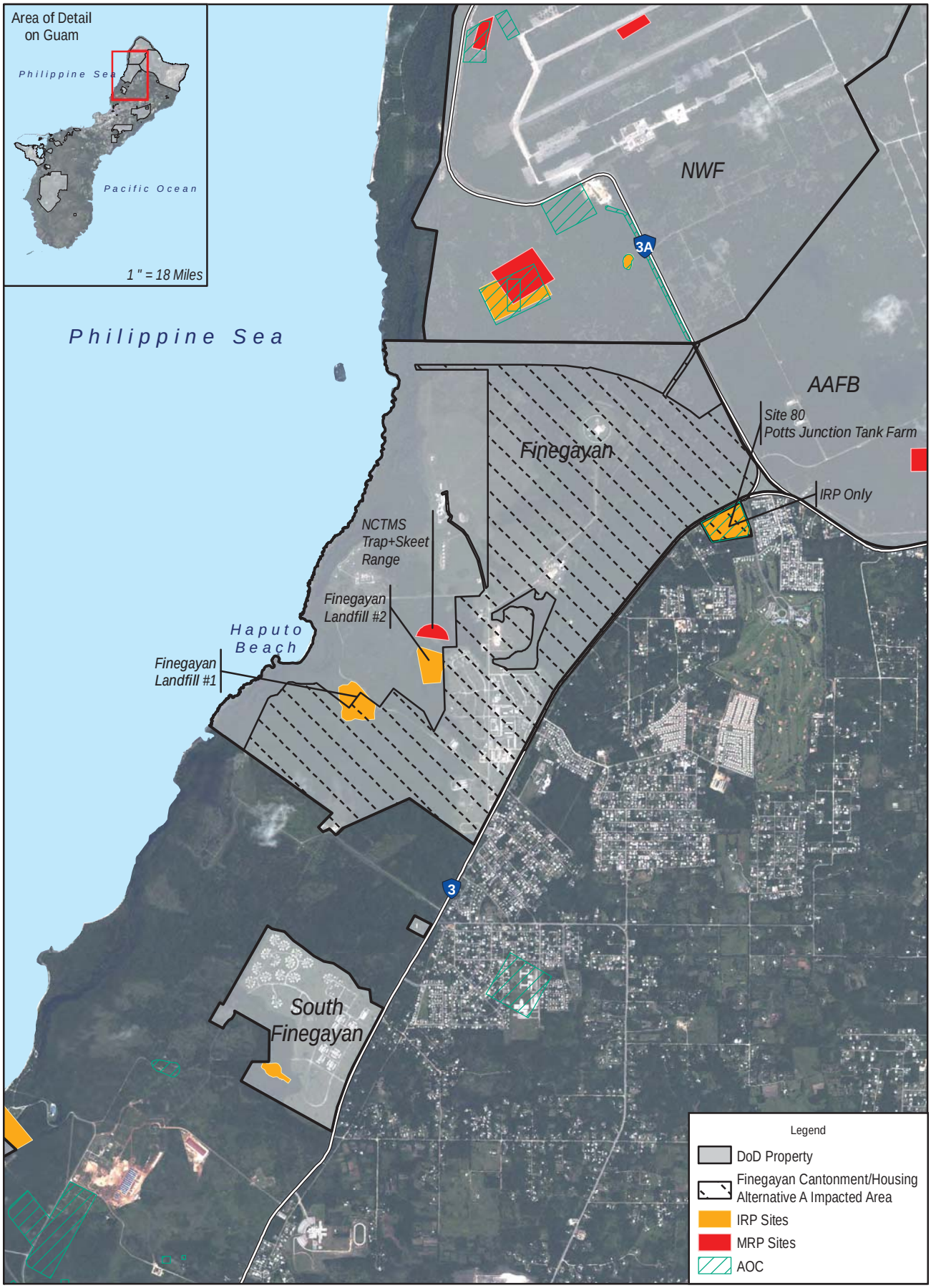


Figure 4.1.16-1
Active and Restricted IRP Sites, MMRP Sites, and AOC
in the Vicinity of Finegayan Cantonment/Housing Alternative A

Source: NAVFAC Pacific 2013

Finegayan

There are numerous structures located on Finegayan that may be affected by the proposed development of the cantonment/family housing under this alternative. Any structure constructed prior to 1978 may contain ACM, LBP, and PCBs.

According to USEPA, the parcel is located in an area classified as Zone 1 for Radon indicating average indoor radon levels of greater than picocuries per liter (4 pCi/L).

Potts Junction

Currently, there are no structures located on Potts Junction. Therefore, LBP, ACM and PCBs are not likely to be present. Elevated levels of lead and other contaminants associated with its former use as a fuel tank farm may be present in site soils.

According to USEPA, the parcel is located in an area classified as Zone 1 for Radon indicating average indoor radon levels of greater than 4 pCi/L.

4.1.16.2 Environmental Consequences

Hazardous Materials Management

Construction

Construction activities would result in a short-term increase in the use of hazardous materials that would cease at the completion of construction activity. The majority of the hazardous materials expected to be used are common to construction and include diesel fuel, gasoline, and propane to fuel the construction equipment; hydraulic fluids, oils and lubricants; welding gases, paints, solvents, adhesives, and batteries. For purposes of the impact analysis, it was assumed that the short-term increased volumes of hazardous materials and waste that were considered in the 2010 Final EIS analysis would be reduced because of the generally reduced amount of construction required for the downsized cantonment/family housing area reflected in this SEIS. The volumes of hazardous materials presented in the 2010 Final EIS were derived from the volumes of hazardous materials and waste required to accommodate the Marine Corps at their current location in Okinawa, Japan. The 2010 Final EIS (Volume 2: Chapter 17: Hazardous Materials and Waste, Section 17.2.2.2: Construction Activities, page 17-44) estimated that construction activity would result in an increase to the Guam hazardous material use rate of 10% of the known Okinawa rate, or approximately 3,200 pounds (1,451 kg) annually (DRMO Okinawa). The overall reduction in short-term increased use of hazardous materials during construction under the SEIS alternatives, as compared to the 2010 Final EIS, would be dependent on a variety of factors and cannot be quantified based on available information. Although reduced relative to the 2010 Final EIS volumes of hazardous materials, the construction of Alternative A would still represent a substantial short-term increase in the volume of hazardous materials relative to baseline conditions, and this alternative would have the potential to result in direct short-term adverse impacts to human health and the environment (i.e., soils, surface water, groundwater, air, and biota). However, the hazardous materials would be handled and disposed of per the applicable BMPs and SOPs identified in the 2010 Final EIS, which would also be applied under this alternative (Volume 2: Chapter 17: Hazardous Materials and Waste, Table 17.2-3: Summary of BMPs and SOPs, pages 17-42 to 17-43 and Volume 7: Proposed Mitigation Measures, Preferred Alternatives, Impacts and Cumulative Impacts, Chapter 2: Overview of Best Management Practices and Mitigation Measures, Table 2.1-1. Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23) and summarized in Chapter 2 of this SEIS. Adherence to applicable BMPs and SOPs would reduce the likelihood and volume of accidental releases, allow for accelerated spill response times and enable

timely implementation of cleanup measures, thereby minimizing potential impacts to the environment. Therefore, the short-term increase in volume would result in less than significant direct and indirect impacts.

Should there be a need to import off-island earthen materials, all GEPA, Department of Agriculture, and local rules and regulations would be followed.

Construction and demolition contractors would be required to comply with all applicable requirements concerning handling of construction-related hazardous substances. Hazardous materials associated with construction activities would be delivered and stored in a manner that would prevent these materials from leaking, spilling, and potentially polluting soils, ground and surface waters and in accordance with applicable federal, state, and local regulations. Public transportation routes would be utilized for the conveyance of hazardous materials to the construction site. Transportation of all materials would be conducted in compliance with U.S. Department of Transportation regulations. Therefore, the short-term increase in the use, transport, storage and handling of hazardous materials during construction would have no significant direct or indirect impacts. Should suspected environmental contamination be encountered during construction activities, work would stop and the appropriate authorities would be notified. If appropriate, soil and groundwater samples would be collected to determine the nature and the extent of the contamination and whether remedial action would be required.

Construction and demolition activities associated with this alternative would have no long-term direct or indirect impact on the management of hazardous materials at DoD facilities on Guam. Hazardous materials would continue to be managed under established hazardous material SOPs. Indirect Long-term beneficial impacts would occur to fuel storage and conveyance infrastructure as it would need to be brought into compliance before planned increases in capacity could be implemented.

Operation

Marine Corps Relocation. The proposed increase of DoD personnel and dependents to Guam would increase the transport/transfer of hazardous materials on Guam. It is expected that the largest long-term increases of hazardous materials on Guam would occur from the use of POL, which includes gasoline, aviation fuels, diesel, oil, grease, kerosene, and other related products. These materials are largely used for the maintenance and operation of military vehicles and other assets. Potential effects, impacts, and mitigation measures associated with hazardous materials transport to Guam and transfer on Guam were summarized in the 2010 Final EIS (Volume 2: Chapter 17: Hazardous Materials and Waste, Table 17.2-3: Summary of BMPs and SOPs, pages 17-42 to 17-43 and Volume 7: Proposed Mitigation Measures, Preferred Alternatives, Impacts and Cumulative Impacts, Chapter 2: Overview of Best Management Practices and Mitigation Measures, Table 2.1-1. Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23) and it was noted that BMPs and SOPs would be implemented and were not considered "mitigation measures." Therefore, no potential mitigation measures were identified. For purposes of the impact analysis, it was assumed that the long-term increased volumes of hazardous materials and waste that were considered in the 2010 Final EIS analysis would be reduced because of the generally reduced amount of operations required for the downsized personnel relocation reflected in this SEIS. The volumes of hazardous materials presented in the 2010 Final EIS were derived from the volumes of hazardous materials and waste required to accommodate the Marine Corps at their current location in Okinawa, Japan. Currently, the Marine Corp at Okinawa uses approximately 32,389 pounds (14,691 kg) of hazardous materials annually. These materials are largely POLs. The 2010 Final EIS (Volume 2: Chapter 17: Hazardous Materials and Waste, Section 17.1.3.1: Hazardous Materials Storage, Use, and Handling, page 17-7) estimated that the proposed transfer of Marines to Guam would result in a

long-term increase to the Guam hazardous materials volume of 50% of the known Okinawa DRMO disposal rate, or approximately 16,000 pounds (7,257 kg) annually (DRMO Okinawa 2009) (2010 Final EIS Volume 2: Chapter 17: Hazardous Materials and Waste, Table 17.2-3: Summary of BMPs and SOPs, pages 17-43). The overall reduction in long-term increased use of hazardous materials from operations under the SEIS alternatives, as compared to the 2010 Final EIS, would be dependent on a variety of factors and cannot be quantified based on available information. Although reduced relative to the 2010 Final EIS volumes of hazardous materials, operations under Alternative A would still represent a substantial long-term increase in the volumes of hazardous materials relative to baseline conditions.

Long-term increases in hazardous materials would not require DRMO on Guam to expand its hazardous materials handling and storage capacity. Due to the projected long-term increase in hazardous materials, this alternative would have the potential to result in direct adverse impacts to human health and the environment (i.e., soils, surface water, groundwater, air, and biota). However, the increased amount of hazardous materials would be handled and disposed per the applicable BMPs and SOPs identified in the 2010 Final EIS (Volume 2: Chapter 17: Hazardous Materials and Waste, Table 17.2-3: Summary of BMPs and SOPs, pages 17-43 and Volume 7: Proposed Mitigation Measures, Preferred Alternatives, Impacts and Cumulative Impacts, Chapter 2: Overview of Best Management Practices and Mitigation Measures, Table 2.1-1: Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23) and summarized in Chapter 2 of this SEIS. Adherence with applicable BMPs and SOPs would reduce the likelihood and volume of accidental releases, allow for accelerated spill response times and enable timely implementation of cleanup measures, thereby minimizing potential direct or indirect impacts to the environment and resulting in less than significant impacts.

Increases in hazardous materials transport, storage, and use to support long-term increased training operations under the proposed action would also be managed in compliance with MCO P5090.2A. This order implements procedures and protocols governing a number of environmental concerns, including the handling of hazardous materials and petroleum, oils, and lubricants. These procedures and protocols include, but are not limited to, spill control and response, disposal of battery waste, and fuel storage restrictions. By following procedures outlined in MCO 5090.2A, personnel would avoid releases of contaminants during training and operations, thus mitigating any appreciable direct or indirect impact to the surrounding environment as a result of the proposed action. Therefore, direct and indirect impacts would be less than significant.

Cantonment. Long-term increases in the use of hazardous materials are expected to be minimal as a result of the increase in cantonment activities. The 2010 Final EIS estimated that these activities would result in an increase to the Guam hazardous material use rate of 1% of the known Okinawa rate, or approximately 320 pounds (145 kg) annually (DRMO Okinawa 2009) (2010 Final EIS Volume 2: Chapter 17: Hazardous Materials and Waste, Section 17.2.2.3: Operation, page 17-47). The number of Marines and dependents relocating to Guam has been reduced by 64%. For this analysis, it is assumed that a similar 64% reduction in the increase in hazardous materials would occur from the reduction in personnel. Therefore, a long-term increase in hazardous materials volume of 115 pounds (52 kg) is anticipated from cantonment activities. The existing hazardous waste accumulation sites at Finegayan would be maintained to support the proposed cantonment area and a 90-day accumulation area would be provided. In addition, an undetermined number of satellite accumulation sites would be created, as needed, in proximity to hazardous materials use and hazardous waste generation to support cantonment activities. This impact is considered negligible and no potential mitigation measures are proposed.

Hazardous Waste Management

Construction

Construction activities would result in a short-term increase in the generation of hazardous waste that would cease at the completion of construction activity. Hazardous waste generated from construction activities includes pesticides, solvents, adhesives, lubricants, corrosive liquids, batteries, and aerosols. For purposes of the impact analysis, it was assumed that the increased volumes of hazardous waste that were considered in the 2010 Final EIS analysis would be reduced because of the generally reduced amount of construction required for the downsized cantonment/family housing area reflected in this SEIS. The 2010 Final EIS (Volume 2: Chapter 17: Hazardous Materials and Waste, Section 17.2.2.2: Construction Activities, page 17-44) estimated that construction activity would result in an increase in hazardous waste generation on Guam of 10% of the known Okinawa rate, or approximately 64,400 pounds (29,211 kg) annually (DRMO Okinawa 2009). The overall reduction in short-term generation of hazardous wastes from construction under the SEIS alternatives, as compared to the 2010 Final EIS, would be dependent on a variety of factors and cannot be quantified based on available information. Although reduced relative to the 2010 Final EIS volumes of hazardous materials and waste, construction under Alternative A would still represent and substantial short-term increase in the volumes of hazardous waste relative to baseline conditions.

Due to the projected short-term increase in hazardous waste, this alternative would have the potential to result in direct adverse impacts to human health and the environment (i.e., soils, surface water, groundwater, air, and biota). However, the short-term increase in hazardous waste would be handled and disposed per the applicable BMPs and SOPs identified in the 2010 Final EIS (Volume 2: Chapter 17: Hazardous Materials and Waste, Table 17.2-3: Summary of BMPs and SOPs, page 17-42 and Volume 7: Proposed Mitigation Measures, Preferred Alternatives, Impacts and Cumulative Impacts, Chapter 2: Overview of Best Management Practices and Mitigation Measures, Table 2.1-1. Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23) and summarized in Chapter 2 of this SEIS. Adherence with applicable BMPs and SOPs would reduce the likelihood and volume of accidental releases, allow for accelerated spill response times, and allow for the timely implementation of cleanup measures, thereby minimizing potential direct impacts to the environment and resulting in less than significant impacts.

Should there be a need to import off-island earthen materials, all GEPA, Department of Agriculture, and local rules and regulations would be followed.

Construction and demolition contractors would be required to comply with all applicable requirements concerning handling of construction related hazardous waste. Hazardous waste generated by construction activities would be stored in a manner that would prevent these materials from leaking, spilling, and potentially polluting soils, ground and surface waters and in accordance with applicable federal, state, and local regulations. Public transportation routes would be utilized for the conveyance of hazardous waste to the disposal facility site. Transportation of all hazardous waste would be conducted in compliance with U.S. Department of Transportation regulations. Therefore, the short-term increase in the generation, transport, storage and handling of hazardous waste during construction would be less than significant.

Construction and demolition activities associated with this alternative would have no long-term direct or in-direct impact on the management of hazardous waste at the DoD facilities on Guam. Hazardous waste would continue to be managed under established hazardous waste SOPs.

Operation

Marine Corps Relocation. The proposed increase of DoD personnel and dependents to Guam would increase the transport/transfer of hazardous waste on Guam. It is expected that the largest increases of hazardous waste on Guam would occur from discarded POL including waste oil, grease, solvents and other related products. These materials are largely used for the maintenance and operation of military vehicles and other assets.

Currently, the Marine Corps in Okinawa disposes of 611,828 pounds (277,520 kg) of hazardous waste annually. These materials are largely POLs. The 2010 Final EIS (Volume 2: Chapter 17: Hazardous Materials and Waste, Section 17.2.2.1: Transportation to and on Guam-Hazardous Materials, page 17-40 to 17-43) estimated that the proposed transfer of Marines and dependents to Guam would result in a long-term increase to the Guam hazardous waste volume of 50% of the known Okinawa DRMO disposal rate, or approximately 306,000 pounds annually (DRMO Okinawa 2009). For purposes of the impact analysis, it was assumed that the long-term increased volumes of hazardous waste that were considered in the 2010 Final EIS analysis would be reduced because of the generally reduced amount of operations required for the proposed action analyzed in this SEIS. The overall reduction in long-term increased generation of hazardous wastes from operations under the SEIS alternatives, as compared to the 2010 Final EIS, would be dependent on a variety of factors and cannot be quantified based on available information. Although reduced relative to the 2010 Final EIS volumes of hazardous waste, operations under Alternative A would still represent and substantial long-term increase in the volumes of hazardous materials and waste relative to baseline conditions.

Cantonment. Increases in the generation of hazardous waste were expected to be negligible in the 2010 Final EIS as a result of construction activities for cantonment/family housing. The 2010 Final EIS (Volume 2: Chapter 17: Hazardous Materials and Waste, page 17-49) estimated that these activities would result in an increase to the Guam hazardous waste disposal rate of 1% of the known Okinawa rate, or approximately 6,118 pounds annually (DRMO Okinawa 2009). For purposes of the impact analysis, it was assumed that the long-term increased volumes of hazardous waste that were considered in the 2010 Final EIS analysis would be reduced because of the generally reduced amount of operations required for the downsized personnel relocation reflected in this SEIS. The overall reduction in long-term increased generation or hazardous wastes from operations under the SEIS alternatives, as compared to the 2010 Final EIS, would be dependent on a variety of factors and cannot be quantified based on available information. Although reduced relative to the 2010 Final EIS volumes of hazardous waste, operations under Alternative A would still represent and substantial long-term increase in the volumes of hazardous materials and waste relative to baseline conditions. Routine hazardous waste BMPs and SOPs would be implemented as identified in the 2010 Final EIS Volume 2, Chapter 17: Hazardous Materials and Waste, Table 17.2-3: Summary of BMPs and SOPs, page 17-41 and Volume 7, Chapter 2: Overview of Best Management Practices and Mitigation Measures, Table 2.1-1. Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23) and summarized in Chapter 2 of this SEIS. Therefore, long-term direct or indirect impacts are considered less than significant. No potential mitigation measures are proposed.

Finegayan currently contains two satellite 90-day hazardous waste storage areas that would be maintained under this alternative. The existing hazardous waste accumulation sites at Finegayan do not have adequate capacity to support the proposed cantonment area. Therefore, an undetermined number of satellite accumulation sites would be created, as needed, in close proximity to the locations within the cantonment where the hazardous materials are used and hazardous wastes are generated. These areas would be

managed in accordance with applicable regulations and the facility Hazardous Waste Management Plan to minimize the likelihood of accidental releases and resulting impacts. Therefore, impacts would be less than significant.

Contaminated Sites

Construction

As described in the 2010 Final EIS (Volume 9: Appendices, Appendix G: EIS Resource Technical Appendix, Chapter 3: Hazardous Materials and Waste Resources, pages 17-12 to 17-14) and in Chapters 3 and 4 of this document, there are contaminated sites undergoing characterization and/or restoration under various DoD environmental programs located within or in close proximity to the proposed construction areas. Consideration and careful attention during project design phases must be given prior to construction to avoid overlap with these sites. If relocation of proposed construction projects that may overlap these contaminated sites is not possible, then various BMPs and construction operational protocol must be followed to protect human health and the environment. In addition, special design techniques and methodology would be required to ensure the long-term structural integrity of proposed construction projects. At this time, no construction is proposed directly on the site and groundbreaking activities are not likely to be permitted. Land use controls such as fencing and signage may be used to restrict access to the site and minimize any direct or indirect impacts. Therefore, impacts to these sites would be less than significant.

Operation

Under Alternative A, direct or indirect impacts to contaminated sites from operations would be less than significant. Any potentially contaminated sites would be assessed and remediated, as appropriate, for the proposed reuse of the site. Operational activities would not disturb any remediation sites or controls or interfere with monitoring areas, if present.

Toxic Substances

Construction

Demolition and construction activities associated with Alternative A would have no direct or indirect adverse impacts on toxic substances. The demolition of older buildings and/or utilities may result in encountering PCBs, ACM and LBP that were used in the older building materials. If PCBs, ACM, and/or LBP are encountered during demolition, licensed contractors would be used for these projects to ensure that all DoD, federal, state, and local PCBs, ACM, and LBP testing, handling, and disposal protocol, procedures, and requirements are followed. Toxic substances would not be utilized for new construction. LBPs and most uses of PCBs have been banned by USEPA. Although not a banned substance, ACM would not be used to construct proposed new facilities on Guam. Because the proposed construction areas are located in a USEPA Radon Zone 1, it is possible that new buildings, facilities and structures could encounter radon intrusion. To minimize this impact, radon resistant construction techniques and potential mitigation systems considered may be incorporated into the building/facility designs in accordance with the Navy's Radon Assessment and Mitigation Program and OPNAVINST 5090.1D. Provisions implemented under Navy's Radon Assessment and Mitigation Program include: Identification of buildings where EPA actions levels of 4 pCi/L are exceeded; maintain a central data management system containing all the validated monitoring data results of Navy buildings (owned or leased); mitigate indoor radon levels in buildings to below 4 pCi/L; perform inspections and preventative maintenance of mitigation systems and periodic retesting at least every 2 years to ensure efficacy of mitigation systems.

Final mitigation measures would be identified in the ROD after resource agency consultations are complete.

Operation

Marine Corps Relocation. When assessing the transport, transfer, and future use of toxic substances associated with the Marine Corps relocation, no significant environmental consequences from ACM, LBP, and PCBs are anticipated. ACM and gases would not be transported or transferred as a result of these activities. Existing BMPs and SOPs (Volume 2: Chapter 17: Hazardous Materials and Waste, Table 17.2-3: Summary of BMPs and SOPs, page 17-41 and Volume 7: Proposed Mitigation Measures, Preferred Alternatives, Impacts and Cumulative Impacts, Chapter 2: Overview of Best Management Practices and Mitigation Measures, Table 2.1-1. Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23) and summarized in Chapter 2 of this SEIS, would be followed, thus, minimizing the potential for releases to the environment. Therefore, toxic substances direct or indirect impacts would be less than significant, and no potential mitigation measures are proposed.

Cantonment. Cantonment operations would have no direct or indirect impact on ACM, LBP, and PCBs. ACM, LBP, and PCBs would not be used in new facilities on Guam. It is possible that new buildings, facilities, and/or structures could encounter radon intrusion. However in this case, radon resistant construction techniques and potential mitigation measures considered may be incorporated into facility designs. Final mitigation measures will be identified in the ROD after resource agency consultations are complete. In addition, the DoD would periodically test facilities constructed in known radon zones to verify that no unacceptable radon gas buildup occurs and install radon mitigation systems, as appropriate. Therefore, toxic substances direct or indirect impacts would be less than significant with the use of appropriate minimization methods.

4.1.17 Public Health and Safety

4.1.17.1 Affected Environment

The affected environment and potential impacts on public health and safety, including notifiable diseases, mental illness, and traffic incidents, are addressed below in relation to the current population of Guam and the per capita rates of occurrence for each of these public health and safety factors. Site-specific health and safety concerns (for the proposed alternatives for cantonment/family housing and the LFTRC) are discussed in Chapters 4 and 5. An extensive discussion of the affected environment for public health and safety matters on Guam is provided in the 2010 Final EIS (Volume 2, Chapter 18: Public Health and Safety, Section 18.1: Affected Environment, pages 18-1 to 18-12).

Notifiable Diseases

The topic of notifiable diseases is addressed in relation to the current population of Guam and the per capita rates of occurrence. As such, the discussion of notifiable diseases is not site-specific but rather island wide, and applies to all cantonment/family housing alternatives.

Notifiable diseases (including cholera, dengue, hepatitis C, malaria, measles, rubella, typhoid fever, and tuberculosis) were addressed in the 2010 Final EIS. Based on the analysis performed for the 2010 Final EIS (Volume 2, Chapter 18: Public Health and Safety, Section 18.2.23: Notifiable Diseases, page 18-19), it was determined that despite an increase of approximately 79,000 people, no significant increase in disease occurrence would result. Because the proposed Marine Corps relocation now includes far fewer personnel, no significant increase in those diseases would still be anticipated. Therefore, these notifiable

diseases would not be an impact of the supplemental action and are not addressed further in this SEIS. AIDS and STDs have high incident rates on Guam and are addressed further in this SEIS.

Acquired Immune Deficiency Syndrome. AIDS is an infectious disease caused by the human immunodeficiency virus. AIDS is the advanced form of infection with the human immunodeficiency virus, which may not cause recognizable symptoms for a long period after the initial exposure. No vaccine is currently available to prevent human immunodeficiency virus infection. At present, all forms of AIDS therapy are focused on improving the quality and length of life for AIDS patients by slowing or halting the replication of the virus and treating or preventing infections and cancers that take advantage of a person's weakened immune system. The average number of AIDS cases on Guam over the past 10 years is about four cases per year. The average per capita occurrence of AIDS patients is 0.0000277. This equates to one case of AIDS for every 36,043 people on Guam (Table 4.1.17-1).

Table 4.1.17-1. AIDS Reports, Guam 2001-2011

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*Average*	*Total*
Cases	9	4	9	0	3	0	4	6	2	6	6	4.4	49
Rate	1/17,370	1/39,265	1/17,508	0	1/52,799	0	1/39,741	1/26,528	1/79,661	1/26,559	1/26,600	1/36,043	-

Source: Bureau of Statistics and Plans 2012a.

Sexually Transmitted Diseases (other than AIDS). STDs include Chlamydia, Gonorrhea, and Syphilis, which are transmitted by sexual contact. The 10-year average for STD cases on Guam is approximately 823 per year. This average includes all three diseases. The average per capita STD occurrences on Guam is 0.0052, which equates to one case of an STD for every 192 people on Guam (Table 4.1.17-2).

Table 4.1.17-2. STD Reports, Guam 2001-2011

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*Average*	*Total*
Cases	465	682	669	930	974	961	1,004	435	728	1,009	1,193	822.7	9,050
Rate	1/336	1/230	1/235	1/169	1/162	1/166	1/158	1/365	1/218	1/157	1/133	1/192	-

Source: Bureau of Statistics and Plans 2012a.

A study by the DON and Marine Corps Public Health Center in 2007 calculated rates of occurrence (cases per 100,000 personnel) for STDs among DON and Marine populations. For Marine Corps populations, the rate for Gonorrhea was 51.5 per 100,000 and the rate for Chlamydia was 315.3 per 100,000 (DON and Marine Corps Public Health Center 2008). No statistics had been compiled for incidents of Syphilis.

Mental Illness

The topic of mental illness is addressed in relation to the current population of Guam and the per capita rates of occurrence. As such, the discussion of mental illness is not site-specific, but rather island wide. Mental illness can be any of a variety of psychiatric conditions, usually characterized by impairment of an individual's normal cognitive, emotional, or behavioral functioning, and caused by physiological or psychosocial factors. The 10-year average for mental illness cases on Guam is approximately 126 per year. The average per capita mental illness occurrences on Guam is 0.000797, which means there would be one case of mental illness for every 1,254 people (Table 4.1.17-3).

Table 4.1.17-3. Mental Illness Reports, Guam 2001-2011

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*Average*
Cases	204	177	154	155	153	153	151	95	99	85	117	126.4
Rate	1/766	1/887	1/1,023	1/1,019	1/1,035	1/1,043	1/1,052	1/1,675	1/1,609	1/1,874	1/1,364	1/1,254

Source: Bureau of Statistics and Plans 2012a.

Regarding combat-related mental illness in Marine Corps Soldiers, a study published in 2004 estimated the risk for Post-Traumatic Stress Disorder (PTSD) from service in the Iraq War at 18% and the estimated risk for PTSD from the Afghanistan War at 11% (approximately 1 in 5 personnel deployed to Iraq or Afghanistan returned with some type of psychological health issue). According to a report from the National Center for PTSD, early symptoms of PTSD are not very good predictors of a long-term prognosis. Studies suggest that in the face of severe military service demands, including combat, most men and women do remarkably well across their lifespan. However, if the mission is experienced as a failure, if Soldiers deploy more than once, if new veterans who need services do not get the support they need, or if post-deployment demands and stressors mount, the lasting mental health toll of their exposure may increase over time. According to the National Center for PTSD, a person is more likely to develop PTSD if he or she was injured during the event, the trauma was long-lasting, or if the person felt helpless during the trauma (Naval Center for Combat & Operational Stress Control 2013).

Operational Safety

To protect the general public from intentional or accidental entry onto Finegayan, locked or manned gates are used where vehicle access is provided and a series of signs warning unauthorized personnel not to enter the area are posted along the perimeter of the installation. Unauthorized personnel are not allowed on the installation at any time.

A small arms range is situated on the west-central portion of the property. Activities at this range are conducted in accordance with SOPs to ensure the safety of both range participants as well as the public.

A portion of Finegayan is reserved for communication operations. These areas are essential for the current mission, which is to provide continuous global and universal communications services to fleet units, shore activities, other federal agencies, and joint forces. These reserved areas include EMR hazard safety zones for emitters to ensure the safety of workers and the public.

Environmental Health Effects

Noise

There are no airfields or airfield operations located at Finegayan that generate noise. However, aircraft take-off/departure from AAFB flies over Finegayan, generating noise in the range of 60-65 dBA. Current noise levels are within the acceptable range for residential facilities. Details regarding current noise conditions at Finegayan are provided in Section 4.1.4.1.

Water Quality

Several water wells are situated within the Finegayan boundary or are immediately adjacent to the installation. These wells each have a mandated 1,000-foot (305-m) buffer identified as a wellhead protection zone. Within this zone, future activities and development are restricted to ensure contaminants are not introduced in these areas, thus protecting the integrity of the island's freshwater aquifers. Guam's freshwater aquifers are susceptible to contamination from surface activities. GEPA requires treatment to ensure water quality meets safe drinking water standards. Section 4.1.2.1 provides details regarding current quality of potable water sources.

Hazardous Substances

Current management practices and contingency plans for the use, handling, storage, transportation, and disposition of hazardous substances associated with Finegayan ensure exposure to the environment and human contact are minimized.

The IRP focuses on cleaning up releases of hazardous substances that pose risks to the public and/or the environment. Several IRP sites are situated within Finegayan. These sites include Finegayan Landfill #1 and Finegayan Landfill #2. Landfill #1 contains buried metals, scrap wood, solvents, and other industrial waste, as well as municipal refuse. Landfill #2 contains building rubble and demolition debris, waste oils, solvents, insulation materials, PCB-containing oils, and oil filters. Water sampling detected concentrations of lead well below the federal maximum contaminant level for drinking water and determined that the lead concentrations detected may reflect background levels in the groundwater in northern Guam, and that no contaminants migrated from the landfills into groundwater. Site investigation field work has been completed at these sites. No significant health hazards have been observed from sampling events. However, the sites have not yet been closed. The hazardous materials and waste section of this SEIS (Section 4.1.16) provides additional detail for the status of IRP sites.

Unexploded Ordnance

Based on previous investigations at Finegayan, UXO is known to be present (DON 2012). The source documentation does not provide the specific location of UXO at Finegayan. However, Guam was an active battlefield during WWII and UXO is known to be present as a result of military activities.

Traffic Incidents

The GPD has instituted traffic safety checkpoints and safety education programs across the island. The number of traffic incidents between 2008 and 2011 averages 7,141 per year. The number of traffic accident-related fatalities averages 12 per year. The average per capita accident rate is 0.045, which means that 1 in every 22 people would experience a traffic accident, whereas the average per capita traffic fatality rate is 0.000075, meaning 1 in every 13,300 people would become a victim of a traffic fatality. Island-wide projects that are implemented to minimize accident potential include school zone signs, village road safety and warning signs, seashore protection, pavement markers, anti-skid surfacing, and guardrails. The nearest high crash frequency location in the vicinity of Finegayan is the intersection of Route 1 and Route 3 (approximately 3 miles [4.8 km] south of Finegayan). This intersection has been identified by GPD as having a high frequency of traffic incidents.

4.1.17.2 Environmental Consequences

Notifiable Diseases

Accounting for the natural increase in the Guam population as well as the proposed increase in military and dependent personnel, the total Guam population would be approximately 175,436 in 2028. Using the average per capita rates for notifiable diseases on Guam, the potential increase in disease occurrences was estimated based on the natural increase in population and the anticipated arrival of military personnel and their dependents. The construction workforce visiting Guam from other countries to support construction requirements (peak construction force of 3,227 in 2018) would have the potential to contribute notifiable disease incidents during the peak construction period (2018 to 2022). A discussion of medical care for island residents is provided in Section 4.1.15, Socioeconomics and General Services.

With construction activities, there is a potential for standing water and water based vectors such as mosquitoes and related diseases. Most mosquitoes require quiet, standing water or moist soil where flooding occurs to lay their eggs. Removal of standing water sources and/or promotion of drainage would eliminate potential breeding sites. In compliance with GCA (10 GCA 36, Mosquito Control), to limit the amount of standing water at construction sites, stagnant water pools, puddles, and ditches would be drained or filled; containers that catch/trap water (e.g., buckets, old tires, cans) would be removed; and if

necessary, pesticide application (e.g., *Bacillus thuringiensis*) could be used to help control mosquitoes. Implementing these BMPs would reduce the opportunities for an outbreak of water-related diseases.

The potential increase in AIDS and STD occurrences based on the estimated 2028 Guam population is presented in Table 4.1.17-4. Based on the anticipated 2028 population of Guam, the annual number of AIDS cases is not anticipated to increase and would remain at about five cases. The annual number of STD cases could increase by 41 to a total of 914 cases.

Table 4.1.17-4. Potential Disease Occurrence Increase (through 2028)

Disease	*Average Rate*	*Annual Average 2001-2011*	*Action Alternatives*	*No-Action Alternative*[(a)]	*Difference*[(b)]
AIDs	1/36,043	4.4	5	7	0
STDs	1/192	822	914	955	41

Notes: (a) Based on natural increase in population.
(b) Difference between action alternatives increase in average number of diseases per year and the No-Action Alternative increase.

Young adults would be more likely to contract an STD. These increases are not likely to impact the public hospital and other clinics on Guam. Based on the anticipated number of Marines relocating to Guam (approximately 5,000), the annual number of STD cases for Marine Corps personnel could be as high as 18 cases. Military personnel with STDs would have the potential to transmit the disease to civilians during social contact. Military installations have hospitals and clinics that would treat military personnel. Therefore, the presence of additional military personnel and their dependents is not expected to increase stress on the public hospital and other clinics on Guam. Based on both the potential for a small increase in STDs, less than significant impacts on health care services would be anticipated.

Mental Illness

A potential increase in mental illness occurrences due to the addition of military personnel and dependents, construction workforce, as well as the natural and induced population increase, would be anticipated. Based on the average per capita rates for mental illness on Guam, the potential increase in mental illness occurrences was estimated based on the natural increase in population as well as the anticipated military personnel moving to Guam. Based on the anticipated 2028 population of Guam, the annual number of mental illness cases could increase by 14 to a total of 140 cases. Based on the potential for a small increase in mental illness cases, less than significant impacts on health care services would be anticipated.

Based on a study published in 2004 that estimated the risk for PTSD from service in the Iraq War at 18% and the estimated risk for PTSD from the Afghanistan War at 11% (approximately 1 in 5 personnel deployed to Iraq or Afghanistan returned with some type of psychological health issue), the relocation of approximately 5,000 Marines to Guam could bring approximately 1,000 cases of PTSD. However, not all service members relocating to Guam have seen duty in Iraq or Afghanistan. Therefore, the number of individuals that may experience PTSD would be much lower. Military installations have hospitals that treat military personnel. Therefore, the presence of additional military personnel is not expected to increase stress on the public hospital and other clinics on Guam. Based on the potential for an increase in PTSD cases and the presence of military medical facilities to treat individuals with PTSD, no adverse impact on health care services is anticipated.

Operational Safety

To protect the general public from intentional or accidental entry onto Finegayan, locked or manned gates would continue to be used where vehicle access is provided and a series of signs warning unauthorized personnel not to enter the area would remain posted along the perimeter of the installation. Unauthorized personnel would not be allowed on the installation at any time.

The primary operational activities that would occur within the cantonment/family housing area include:

- Administrative, supply, service, and maintenance functions for operational units.
- Base support functions.
- Unaccompanied personnel housing and related support functions (e.g., school, child development center, youth center).
- Training functions (i.e., classroom instruction and non-live fire training).
- Community support functions.

The only live-fire training that would occur within the cantonment area is proficiency training at the existing small arms range. The safety of the public as well as personnel participating in military training events is a primary consideration for training activities. SOPs require that prior to conducting training activities the public and non-participating personnel would be cleared from the training area so that the only public health and safety issue would be if a training event exceeded the safety area boundaries. Risks to public health and safety are reduced by confirming that the training area is clear.

Specific and documented procedures would continue to be in place to ensure the public is not endangered by operations and training activities. Therefore, Alternative A would result in no direct or indirect impacts on public health and safety (resulting from operations and training activities).

Electromagnetic Safety

Use of Finegayan to support the cantonment/family housing area requirements for relocated Marines would be conducted so that new developments are consistent with established EMR hazard zones. Exposure to electromagnetic emissions would be limited by restricting access to emitters through the use of security fencing, posting warning signs, or locking out unauthorized persons in areas, where practical. Because electromagnetic emission sources would be operated in accordance with applicable safety standards and the public would be excluded from entering areas where emission sources are located, potential long-term impacts from electromagnetic emissions on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to electromagnetic emissions is anticipated.

Construction Safety

During construction activities, a health and safety program would be implemented by the construction contractors based on industry standards for accident prevention. At a minimum, the construction health and safety program would comply with federal and local health and safety regulations. Elements of the safety program would include:

- Responsibilities of construction workers and subcontractors.
- Job site rules and regulations.
- Emergency response procedures.
- Safety inspections and audits.
- Location of medical services and first aid.

- Safety meetings, employee training, and hazard communications.
- Personal protective equipment.
- Standard construction procedures.
- Accident investigation and reporting.

Because a health and safety program would be implemented for construction activities and the public would be excluded from entering construction areas, potential short-term construction impacts on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to construction activities is anticipated.

Environmental Health Effects

Noise

A detailed discussion of construction and operational noise emissions associated with Alternative A is provided in Section 4.1.4, Noise. Increases in noise emissions associated with implementation of the construction phase of this alternative with identified BMPs would be less than significant. Enforcement of OSHA guidelines for hearing protection for workers would be the responsibility of the construction contractor. The public would be excluded from entering construction areas. Therefore, less than significant short-term construction noise impacts on public health and safety would result. Long-term operational noise from activities occurring within the cantonment/family housing areas would be similar to current noise levels at Finegayan. Therefore, the overall direct or indirect impacts associated with noise to human health and safety would be less than significant.

Water Quality

With the introduction of additional personnel, groundwater withdrawal would likely increase. However, implementation of sustainability practices would reduce the amount of groundwater needed, which would help minimize impacts on groundwater availability. The resulting total annual groundwater production would be less than the sustainable yield and monitoring of groundwater chemistry would identify any emerging issues. In addition, the GWRDG was formed to cooperatively manage the water resources to ensure an adequate and safe water supply. Water wells on and adjacent to Finegayan have a mandated 1,000-foot (305-m) buffer identified as a wellhead protection zone. Proposed development and operational activities would be conducted in accordance with GEPA guidance and BMPs to minimize the potential for contaminants to be introduced in these areas. Therefore, direct and indirect public health and safety impacts from long-term increased demand on potable water and potential water-related illnesses would be less than significant.

Hazardous Substances

Implementation of Alternative A would result in a short-term and long-term increase in the use, handling, storage, transportation, and disposition of hazardous substances. These activities would be conducted in accordance with applicable hazardous material and waste regulations and the following established BMPs and SOPs to ensure that the health and safety of workers and the general public is maintained:

- Implementing Hazardous Materials Management Plans.
- Implementing Facility Response Plans.
- Implementing SPCC Plans (e.g., training, spill containment and control procedures, clean up, notifications). Also, ensure personnel are trained in accordance with spill prevention, control, and cleanup methods.
- Implementing Hazardous Materials Minimization Plans.

- Ensuring DoD personnel are trained as to proper container labeling, storage, staging, and transportation requirements for hazardous materials.
- Ensuring that the DRMO has sufficient hazardous materials storage, transportation, and disposal capacity prior to any expected increases.
- Verifying full compliance with federal, local, and DoD laws and regulations and implement corrective actions as necessary.

IRP investigations and/or remediation activities, as necessary, would continue in an effort to clean up past releases of hazardous substances that pose a risk to the public and the environment and receive regulator concurrence that necessary actions have been completed to ensure the safety of the public. Based on the location of the IRP sites (which does not affect proposed cantonment/family housing areas and is not near an off-site population) and the continuation of investigative/cleanup activities in accordance with applicable regulations and established BMPs and SOPs, no health hazards have been identified. Therefore, no direct or indirect impacts on public health and safety are anticipated.

Unexploded Ordnance

Excavation for building foundations, roads, underground utilities, and other infrastructure could encounter unexploded military munitions in the form of UXO, DMM, and/or MPPEH. Exposure to MEC could result in death or injury to workers. With the exception of public access provisions outlined through the PA process (see Section 4.4.10, Cultural Resources); the general public would be excluded from entering construction zones and training areas. To reduce the potential hazards related to the exposure to MEC, in accordance with DoD Directive 6055.9 (DoD Ammunition and Explosive Safety Standard) and Naval Ordnance Safety and Security Activity Instruction 8020.15D, ESS documentation would be prepared that outlines specific measures that would be implemented to ensure the safety of workers and the public. UXO that is identified during construction of facilities that requires open detonation in-place would require an emergency permit from GEPA. UXO that is safe to transport would be taken to the AAFB Hazardous Waste Management Facility - AAFB Explosive Ordnance Disposal (EOD) Permitted Facility to be safely detonated. BMPs that would be implemented include having qualified UXO personnel perform surveys to identify and remove potential MEC items prior to the initiation of ground-disturbing activities. Additional safety precautions would include having UXO personnel supervision during earth-moving activities and providing MEC awareness training to construction personnel involved in grading and excavations prior to and during ground-disturbing activities that would occur in previously disturbed areas that have a high probability of MEC. In addition, the DON provides MEC awareness training to GovGuam and other public representatives allowing access to project sites to facilitate surveys or collection of natural resources or items of cultural significance prior to conducting vegetation clearance. Because UXO would be identified and removed prior to initiating construction activities and construction personnel would be trained as to the hazards associated with unexploded military munitions, potential direct impacts from encounters with UXO would be minimized and less than significant.

Traffic Incidents

As a result of the long-term increase in military personnel and their dependents, there would be more vehicles on the roadways potentially resulting in more heavily congested roadways and, thus, more potential for accidents and traffic fatalities. Using the average per capita rates for traffic accidents and traffic fatalities on Guam, the potential increase in traffic accidents and traffic fatalities was estimated based on the natural increase in population as well as the anticipated military personnel and their dependents moving to Guam.

The potential increase in traffic accidents and traffic fatalities based on the estimated 2028 Guam population is presented in Table 4.1.17-5. It is estimated that the annual number of traffic accidents could increase by 358 to a total of 7,974 and the number of traffic fatalities could increase by 1 to a total of 13.

Table 4.1.17-5. Potential Traffic Accident Increase, Guam (through 2028)

	Average Rate	*Annual Average*	*Action Alternatives*	*No-Action Alternative* [1]	*Difference* [2]
Accidents	1/22	7,141	7,974	8,929	358
Fatalities	1/13,300	12	13	24	1

Notes: [1]Based on natural increase in population.
[2]Difference between action alternatives and the No-Action Alternative increase.

The DON has used focus group sessions with personnel at several bases to strategize potential measures to reduce the number of liberty incidents, including traffic incidents. Several common factors appear to contribute to liberty incidents including young personnel, late night, impaired driving, and alcohol/drugs. Some of the actions that would be implemented to reduce traffic incidents during liberty include:

- Increase awareness training regarding the consequences of drugs and alcohol use.
- Increase Shore Patrol activity.
- Arrange to have shuttle bus runs to/from town.

Although implementing Alternative A could mean more military personnel on the roads, the actual potential for increased traffic incidents is small (5% increase/358 traffic incidents annually). Because the potential long-term increase in the number of traffic accidents and fatalities as a result of the increase in personnel (as well as the construction workforce contribution) would be minimal and the nearest high crash frequency intersection is located distant to Finegayan, a less than significant impact on the health and safety of the citizens of Guam (from traffic incidents) would be anticipated.

4.1.18 Environmental Justice and the Protection of Children

4.1.18.1 Affected Environment

Data presented in this section are pertinent to the entire island of Guam. Therefore, the affected environment for all alternatives is the same and is covered within this section. Data presented have been updated since the 2010 Final EIS was published and thus similar information that was presented in the 2010 Final EIS is not incorporated by reference.

This section focuses on determining which areas on Guam are considered low-income or minority population areas. This determination is made by comparing data on race/ethnicity and poverty status, in each of Guam's municipalities, to similar data for the U.S. overall. Determinations made are that all municipalities on Guam are considered minority population areas, in comparison to the U.S. overall, and that all municipalities on Guam (with the exception of Santa Rita) are considered low income population areas.

Guam Demographics Related to Environmental Justice

According to the U.S. Census 2010, "Native Hawaiian and Other Pacific Islander" refers to any of the original peoples of Guam, Hawaii, Samoa, or other Pacific Islands. This category includes people who indicated their race or races as Native Hawaiian, Chamorro, Samoan, Carolinian, Chuukese, Tahitian, Mariana Islander, Kosraean, Marshallese, Palauan, Pohnpeian, Yapese, or Other Pacific Islander (U.S. Census Bureau 2010a).

The island of Guam is divided into 19 villages called municipalities. Figure 4.1.18-1 identifies the villages located on Guam, and Table 4.1.18-1 (at the end of this section) provides an overview of racial composition, percentage of households in poverty, and percentage of children for the villages. In general, the various racial and ethnic minority populations are evenly distributed within each of the villages on the island, as are people with lower incomes and children under age 18.

North

Racial or Ethnic Minorities. With 11% or less of their populations being Caucasian, Dededo and Yigo have high percentages of racial and ethnic minorities relative to the U.S. average (Table 4.1.18-1). Seventy-six percent (76%) of Dededo's population is either Chamorro or Filipino, and 65% of Yigo is either Chamorro or Filipino. Both Dededo and Yigo have a slightly higher percentage of Filipinos (43% and 36%, respectively) than Chamorro (33% and 29%, respectively) (U.S. Census Bureau 2010b).

Low-Income Populations. Table 4.1.18-1 compares the percent of residents living in poverty in Dededo and Yigo to that of other villages on Guam and the U.S. population overall. As the data indicate, poverty rates in Dededo and Yigo are similar to those of other villages on Guam and are higher than that of the U.S. overall.

Children. As Table 4.1.18-1 indicates, both Dededo and Yigo have percentages of children similar to those of other Guam villages. These percentages are higher than the U.S. average.

Central

Villages located in central Guam include Barrigada, Hagåtña, Mangilao, Piti, and Tamuning (Figure 4.1.18-1).

Racial or Ethnic Minorities. The percentage of racial or ethnic minorities in the central region ranges from 88% (Asan) to 96% (Hagåtña, Mongmong-Toto-Maite, and Sinajana).These percentages are similar to the percentages of racial minorities in other villages on Guam. However, they are all over twice as high as the average percent of minorities in the U.S. as a whole. There are higher percentages of Chamorros than Filipinos. For example, Mangilao is 49% Chamorro and 20% Filipino, Barrigada is 54% Chamorro and 19% Filipino, and Piti is 59% Chamorro and 8% Filipino (U.S. Census Bureau 2010b).

Low-Income Populations. As indicated in Table 4.1.18-1, a higher percentage of residents in the central region live in poverty compared to the U.S. as a whole (14%). Piti has the lowest percentage of residents living below the poverty line (17%), while Mongmong-Toto-Maite has the highest (30%).

Children. The central region as a whole has a similar percentage of children to other Guam villages. All but one village in the Central Region has a higher percentage of children than the U.S. as a whole (24%). Hagåtña has the smallest percentage of children (24%), while Mongmong-Toto-Maite has the highest (35%).

South

Villages located in southern Guam include Santa Rita, Agat, Umatac, Talofofo, and Yona (Figure 4.1.18-1).

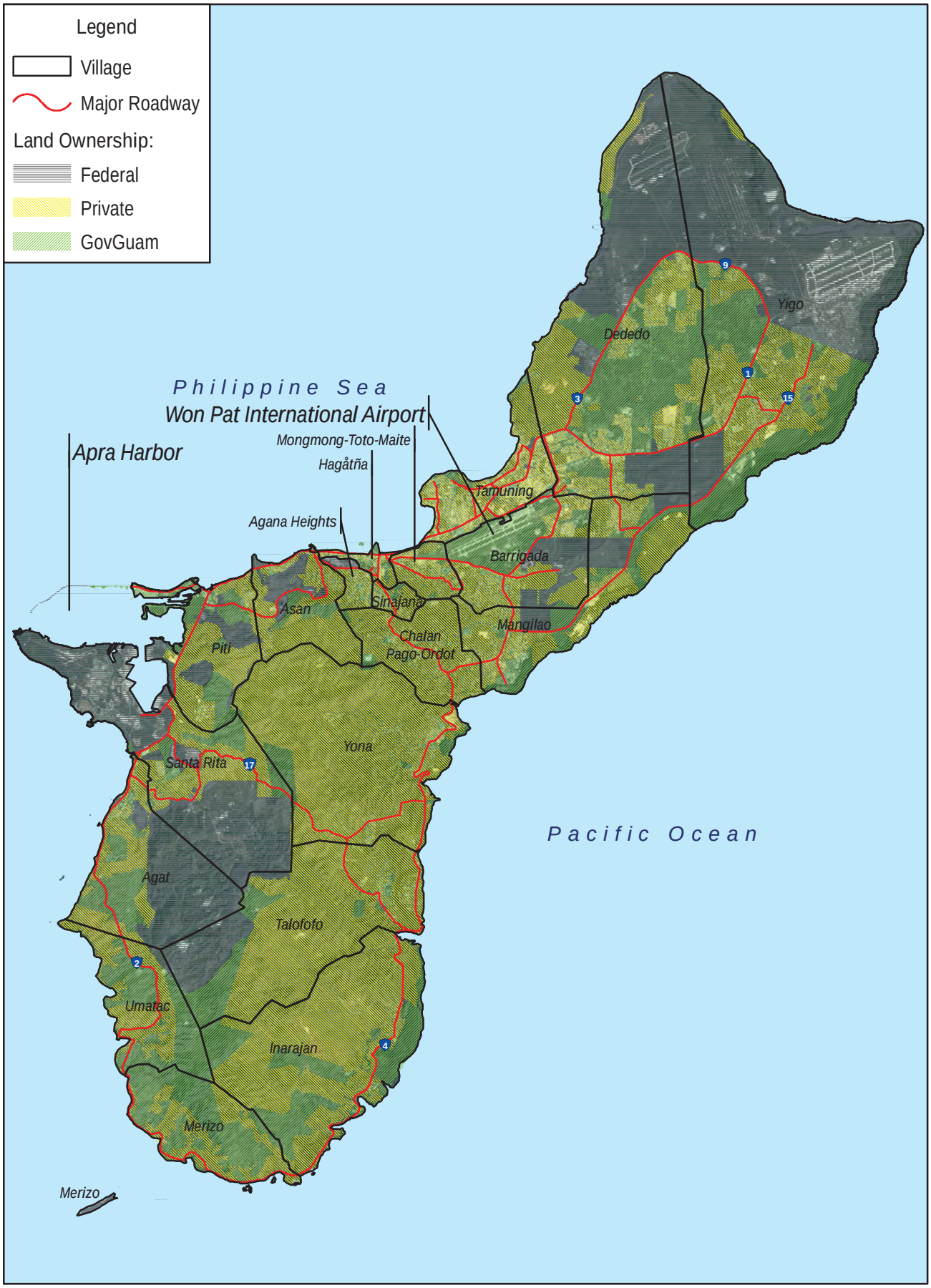


Figure 4.1.18-1
Municipalities of Guam

Racial or Ethnic Minorities. All of the southern villages have percentages of minorities that are at least twice as high as the U.S. average. Santa Rita has one of the highest percentages of Caucasians on Guam (28%) and the lowest proportion of minorities (72%). The population in Santa Rita is 41% Chamorro and 15% Filipino (U.S. Census Bureau 2010b). All of the other southern villages are between 90-98% minorities, as shown in Table 4.1.18-1.

Table 4.1.18-1. Villages Affected by the Proposed Action on Guam: Percentage Ethnic Minorities, in Poverty, and Under 18 Years of Age, 2010

Villages Affected	*Village Minority*[1]	*Guam Average Minority*	*U.S. Average Minority*	*Village Poverty*[2]	*Guam Average Poverty*	*U.S. Average Poverty*	*Village Children*[3]	*Guam Average Children*	*U.S. Average Children*
North									
Dededo	97%	93%	36%	25%	22%	14%	34%	33%	24%
Yigo	89%			22%			35%		
Central									
Agaña Heights	93%	93%	36%	18%	22%	14%	31%	33%	24%
Asan	88%			19%			32%		
Barrigada	94%			20%			32%		
Chalan Pago-Ordot	94%			18%			33%		
Hagåtña	96%			27%			24%		
Mongmong-Toto-Maite	96%			30%			35%		
Mangilao	95%			24%			33%		
Piti	84%			17%			31%		
Sinajana	96%			19%			31%		
Tamuning	91%			23%			26%		
South									
Agat	97%	93%	36%	27%	22%	14%	34%	33%	24%
Inarajan	96%			18%			35%		
Santa Rita	72%			13%			30%		
Merizo	97%			24%			40%		
Talofofo	90%			20%			35%		
Umatac	98%			29%			37%		
Yona	93%			21%			36%		

Notes: [1] All the Guam villages identified in this table have minority populations that are at least two times the percentages of the average minority population in the U.S. (36%).
[2] All but one Guam village (Santa Rita) identified in this table have high percentages of people living in poverty relative to the U.S. average (14%).
[3] All but one Guam village (Hagåtña) identified in this table have higher percentages of children compared to the U.S. average (24%).
Source: U.S. Census Bureau 2010b.

Agat, Talofofo, Umatac, and Yona have some of the highest percentages of Chamorros on Guam (63%, 73%, 87%, and 71%, respectively). While 22% of the population in Agat is Filipino, the percentage of Filipinos in Talofofo, Umatac, and Yona is 7% or less (U.S. Census Bureau 2010b).

Low-Income Populations. The southern region includes the villages, on Guam, with the lowest and the highest percentage of residents living below the poverty line. Santa Rita has the lowest percentage of households in poverty on Guam (see Table 4.1.18-1). Santa Rita's poverty rate (13%) is slightly lower than the U.S. overall (14%) (U.S. Census Bureau 2010b). By the standard employed in this analysis, Santa Rita is the only Guam village that is not considered an environmental justice low-income population area. However, all of the other southern villages have higher percentages of residents living

below the poverty line than the U.S. average, ranging from 19% (Inarajan) to 29% (Umatac). Umatac has the highest poverty rate of any village on Guam.

Children. Except for Santa Rita, the villages of southern Guam all have higher percentages of children residents than Guam does overall (33%). They also have substantially higher percentages of children than the U.S. average (24%). The percentages for southern villages range from 30% (Santa Rita) to 40% (Merizo).

4.1.18.2 Environmental Consequences

This description of environmental consequences addresses all components of the proposed cantonment/family housing at Finegayan. Potential impacts to environmental justice populations would be related to noise, recreation, socioeconomics and general services (including health services), and public health and safety. There would be no land acquisition associated with the cantonment/family housing alternatives, so there would be no impacts to environmental justice associated with land acquisition.

As noted in Section 3.18.3.1, because of the demographic makeup of Guam and Guam's municipalities, disproportionate impacts are only identified if impacts are island-wide and would specifically affect minority and/or low-income populations. Resources that are analyzed include: noise, recreation, socioeconomics and general services, and public health and safety.

Noise

The cantonment/family housing area proposed for construction under the Finegayan Alternative A would require construction activities that would result in direct but short-term noise impacts on the surrounding environment. Under this alternative, minimal to negligible impacts from construction noise, to nearby residents, are expected to result. This is discussed in more detail in Section 4.1.4, Noise. Operational noise would be similar to an office park and residential setting, which would not reach a threshold great enough to cause nearby residents physical harm or stress. Consequently, potential noise impacts under Alternative A for construction activities at Finegayan would be less than significant.

Tier 1: Are there any minority, low-income, or children populations that would be impacted?

Yes, noise-sensitive land uses within the north region of Guam include multi- and single-family residences, parks, churches, and schools. Racial and ethnic minority and low-income populations and children of the villages of Dededo and Yigo are near the proposed action site. Impacts would be direct but short-term and minimal to negligible because increased noise levels from construction activities would be below the USEPA guidelines of 75 dBA L_{eq} as discussed in Section 4.1.4.2, Noise.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action?

No, special-status populations would not be disproportionately affected because the entire region has minority, low-income, and children populations. All residents within the area of noise impacts for Alternative A (see Section 4.1.4) would be affected in the same manner. Therefore, minority and low-income populations would not be disproportionately affected by noise and there would not be disproportionate risks to the health and safety of children as a result of noise.

Recreation

The recreational resources that would be affected by this cantonment alternative are discussed in Section 4.1.7 of this SEIS. While Alternative A would occur on federal land, indirect adverse impacts to

public recreational resources are anticipated due to the arrival of additional military personnel, their dependents, and the H2-B workers that are anticipated to provide much of the labor for the construction effort in the north. As Chapter 9 of the 2010 Final EIS states, this population increase would cause an increase in demand for recreational services, which would likely result in crowding during peak use times (i.e., weekends, holidays, and evenings during summer), as well as increased wear and tear on the resources themselves. While population growth associated with this action would be far less than the growth associated with the 2010 Final EIS, population increases associated with this alternative would nonetheless alter the availability and condition of public recreational resources in northern Guam. The impacts to Recreation under Alternative A would be less than that anticipated under the 2010 Final EIS, because the scope of this proposed action is smaller, and would be less than significant.

Tier 1: Are there any minority, low-income, or children populations that would be impacted?

Yes, the recreational resources are generally used by all people of Guam, which includes a high proportion of racial or ethnic minorities, low-income individuals, and children.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action?

No, minority and low-income populations and children are not disproportionately affected by the increase in demand to recreation areas, because the entire region has minority, low-income, and children populations. All people of Guam would be affected by impacts to recreational resources. Therefore, Alternative A would not result in disproportionately high and adverse effects on minority or low-income populations nor would there be disproportionate risks to the health and safety of children.

Socioeconomics and General Services Impacts

According to Section 4.1.15, Socioeconomics and General Services, health services of the GDPHSS and the GBHWC target the most in-need populations for health care. Therefore, the majority of Guam residents accessing health services from the GDPHSS and the GBHWC are low income and/or uninsured. However, many people with health insurance also use GDPHSS and GBHWC services due to unaffordable insurance co-payments or missing coverage for specific services and medications necessitate that they access the free services of these two public agencies.

Because the number of public health and human service professionals that would be required to maintain current levels of service would increase by more than 2%, there would be significant short-term direct and indirect impacts. However, during the steady-state period, impacts to public health and human service agencies would be considered less than significant. During the short-term period where impacts would be significant, public health service agencies may experience staff shortages which could prove detrimental to the health of Guam residents. As users of Guam's public services, impacts to public health and human service agencies would impact minority, low-income, and children populations.

Tier 1: Are there any minority, low-income, or children populations that would be impacted?

Yes, Public Health and Social Services are used by minorities and special status groups island-wide. As Table 4.1.18-1 indicates, Guam villages have a high percentage of low-income people as compared to the U.S. as a whole. Public health facilities are funded centrally, through GovGuam, so low-income populations throughout Guam would be affected.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action?

Yes, because the GDPHSS and GBHWC's programs are designed to primarily serve the poor and uninsured, low-income populations on Guam, these populations would be disproportionately affected. Minorities and child populations, however, are not disproportionately affected by a reduction in Public Health and Social Services. As indicated in Section 4.1.15, Socioeconomics and General Services, the brief period of maximum population growth during the construction phase would likely increase the number of uninsured and underinsured people attempting to access services provided by GDPHSS and GBHWC. While far fewer in comparison with the proposed action described in the 2010 Final EIS, some temporary workers would likely enter Guam through the Compact of Free Association agreement looking for work associated with this proposed action. Without an increase in staff and other resources, this increase in demand for GDPHSS and GBHWC would strain existing services to low-income residents of Guam.

While all populations on Guam would experience the socioeconomic impacts discussed in Section 4.1.15, Socioeconomics and General Services, lower-income people are more likely to slip into poverty under economic distress. Low-income people are more financially vulnerable because they have fewer resources to support them in difficult economic times. The possible combination of higher costs of goods and services with higher housing costs would likely affect low-income people while those with many resources may thrive economically due to enhanced business opportunities. Stressful economic circumstances may push people on the verge of poverty into poverty or even homelessness. Therefore, Alternative A would likely result in disproportionately high and adverse socioeconomic effects on low-income populations on Guam.

Tier 3: Would the disproportionate adverse effect(s) be significant?

Yes, given that the GDPHSS and GBHWC programs are already strained and have insufficient staffing to support the needs of the existing low-income population on Guam, it is likely that the population increase anticipated as part of the proposed action would have disproportionately high and adverse effects on the low-income and uninsured populations on Guam and these effects would be significant. The existing conditions and potential impacts to Guam's public service agencies from Alternative A are discussed in detail in Section 4.1.15.

Alternative A would have both adverse and disproportionate socioeconomic impacts in terms of environmental justice on low-income populations. However, some of the socioeconomic impacts would be beneficial. The economic impacts would be beneficial overall, leading to increased employment and standards of living as compared to baseline conditions. Implementation of applicable potential mitigation measures, listed in Section 4.1.15, may reduce the strain on GDPHSS and GBHWC health services for the poor and uninsured. In addition, the DoD would lead a federal interagency effort to identify other federal programs and funding sources that could benefit the people of Guam in regards to health care, social services, disease control and/or other assistance to help Guam upgrade their capacity to care for and help prevent increased incidence of illnesses. If these potential mitigation measures are implemented, they would reduce the impacts of the proposed action on low-income populations on Guam.

Potential mitigation measures would include:

- The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded. See Section 2.9 for further discussion on the CMCC. Such support would include providing project-related employment and population forecasts, participating in the identification of shortfalls in Guam public services, and assisting in the

identification of federal programs and funding sources that would help GovGuam to address shortfalls.

- As directed by the FY 2014 NDAA, the DoD would convene the EAC to consider necessary technical and financial assistance and develop an implementation plan coordinated with EAC federal agencies. This plan must be submitted to the congressional defense committees as part of a reporting requirement that is due no later than the date of issuance of the ROD.
- The DoD would continue to support existing programs that contribute and/or donate excess equipment to local agencies.

Since low-income populations would primarily be affected by the impact to Guam's public service agencies, alleviating the impact to the agencies would lessen the impact to low-income populations.

Public Health and Safety

No impacts on public safety are anticipated from operational safety concerns as a result of Alternative A. The potential increase in disease occurrences and mental illness cases as a result of the proposed military relocation would be low. Therefore, less than significant impacts on health care services would occur. No impacts on public health and safety are anticipated from management of hazardous substances. Less than significant impacts are anticipated from noise, water quality, UXO, and traffic incidents due to the increase in military personnel and natural population increase.

However, since the number of public health and safety professionals required to maintain current levels of service at public health and safety agencies would increase by more than 2%, and due to existing deficiencies in facilities and equipment at these agencies (as discussed in Section 4.1.15), there would be short-term, direct and indirect significant impacts to public health agencies and significant direct and indirect impacts on public safety agencies, both short-term and during the steady-state period.

Tier 1: Are there any minority, low-income, or children populations that would be impacted?

Yes, all portions of Guam that could be affected by Alternative A have high percentages of racial minorities, low-income groups, or children.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action?

Yes, low-income populations and children of low-income families would be disproportionately affected by significant adverse impacts to health care services. Impacts to police and fire services would affect all populations on Guam in the same manner. Therefore, impacts to safety services would not be disproportionately high and adverse. Minority populations are not disproportionately affected by the Public Health and Safety issues, because the entire region has a minority population.

Tier 3: Would the disproportionate adverse effect(s) be significant?

Yes, because of the existing sub-standard conditions of health care services on Guam, the impacts of Alternative A on public health care services would be significant on low-income populations and children of low-income families. Potential impacts to low-income populations may be reduced by implementation of applicable measures listed in Section 4.1.15 which include the following:

- The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded. See Section 2.9 for further discussion on the CMCC.

Such support may include providing project-related employment and population forecasts, participating in the identification of shortfalls in Guam public services, and assisting in the identification of federal programs and funding sources that may help GovGuam to address shortfalls.

- The FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $13,000,000 for the construction of a regional public health laboratory on Guam; these funds remain in place. The public health laboratory would alleviate some existing deficiencies in Guam's public health infrastructure, and bolster Guam's capability to meet public health demands brought about by project-related population, by providing a facility that would help identify, treat, and control diseases of public health concern. As directed by the FY 2014 NDAA, the DoD would convene the EAC to consider necessary technical and financial assistance and develop an implementation plan coordinated with EAC federal agencies. This plan must be submitted to the congressional defense committees as part of a reporting requirement that is due no later than the date of issuance of the ROD.

As discussed above, it is anticipated that the potential mitigation measures would reduce the impact to low-income populations, since low-income populations would be the primary population affected by significant impacts to public service agencies.

Summary of Impacts to Environmental Justice

Noise generated by Alternative A would not have disproportionate effects on minority or low-income populations. There would not be disproportionate risks to the health and safety of children resulting from noise, either from the construction activities or during operation of the proposed action. Therefore, there would be less than significant, short-term, direct impacts from noise.

Because all people of Guam would be affected by impacts to recreational resources and public safety resources, there would not be disproportionately high impacts to minority or low-income populations, or to the health and safety of children, during construction or operation. Therefore, there would be less than significant environmental justice impacts from the impacts to recreational and public safety resources.

There likely would be disproportionately significant direct and indirect public health services impacts on low-income populations, during both the construction (short-term) and operational (long-term) phases of the proposed project. Guam's public health services would not be able to handle potential increases in services provided to the medically underserved and low income at the current levels of staffing. Access to public health and social services would be additionally strained by an increase in uninsured and underinsured workers coming to Guam (though to a lesser extent than was discussed in the 2010 Final EIS). The significance of these impacts for Alternative A would similar to that associated with Alternatives B, C, D and E.

The potential short-term population growth may stress some sectors of the Guam economy (e.g., housing, costs of goods and services). This would be felt more severely by low-income people, who often do not have resources to buffer hard economic times (as discussed in Section 4.1.15, Socioeconomics and General Services). However, there would also be some economic benefits due to increased employment opportunities, during both construction activities and operation of the proposed action. Therefore, there would be less than significant impacts during construction, but significant impacts during the operation of the proposed action.

4.2 FINEGAYAN CANTONMENT/SOUTH FINEGAYAN HOUSING - ALTERNATIVE B

Under Alternative B, the proposed development of a cantonment area and family housing would occur at Finegayan and South Finegayan. Details about this alternative are provided in Section 2.4.4.2 and the proposed site is illustrated in Figures 2.4-6 and 2.4-7.

4.2.1 Geological and Soil Resources

4.2.1.1 Affected Environment

The affected environment for geological and soil resources associated under Alternative B is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 3: Geology and Soils Resources, Section 3.1.2.2 Finegayan, pages 3-15 to 3-16) which is summarized below for reference. In addition, the geological and soils affected environment for projects common to all alternatives (i.e., school expansions and off-site utilities) would be similar to that described for Finegayan. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for geological and soil resources, but it would reduce some potential impacts to geological and soil resources that were determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, as described in the analysis of environmental consequences for Alternative B below.

Existing geologic and soil conditions associated with Alternative B are described in Section 4.1.1.1. Conditions at South Finegayan are similar to those described in Section 4.1.1.1 for Finegayan. Young (Mariana) limestone comprises the majority of the bedrock (Figure 4.2.1-1). The South Finegayan parcel is located at an elevation of approximately 300 feet (100 m) above MSL with a general slight downward slope toward the southwest (Figure 4.2.1-2). Based on available topographic and field data, there are 41 features that have been preliminarily identified as sinkholes/depressions that may contain sinkholes in the Alternative B footprint including Finegayan and South Finegayan (South Finegayan parcel has 5; Finegayan parcel has 36 sinkholes/depressions that may contain sinkholes as described in Section 4.1.1.1). Approximately 75% of the South Finegayan parcel soil is classified as Urban Land Complex, due to development for housing and recreational purposes, and the remainder is Guam Cobbly Clay Loam (Young 1988). With respect to geologic hazards (see Section 3.1.1.1) conditions at South Finegayan are similar to those described in Section 4.1.1.1. However, there are no mapped geologic faults in the South Finegayan parcel (Figure 4.2.1-1). In terms of geologic and soils resources, Alternative B replaces development of an undeveloped area in the Finegayan parcel (natural Guam Cobbly Clay Loam soils) with development in a previously disturbed area (Urban Land Complex soils) in the South Finegayan parcel (Figure 4.2.1-2).

4.2.1.2 Environmental Consequences

Potential geology and soil impacts addressed in this section are limited to elements of the proposed action that could affect onshore landforms or that could be affected by geologic hazards. Potential soil contamination issues are addressed in Section 4.2.16.2 of this SEIS (Hazardous Materials and Waste).

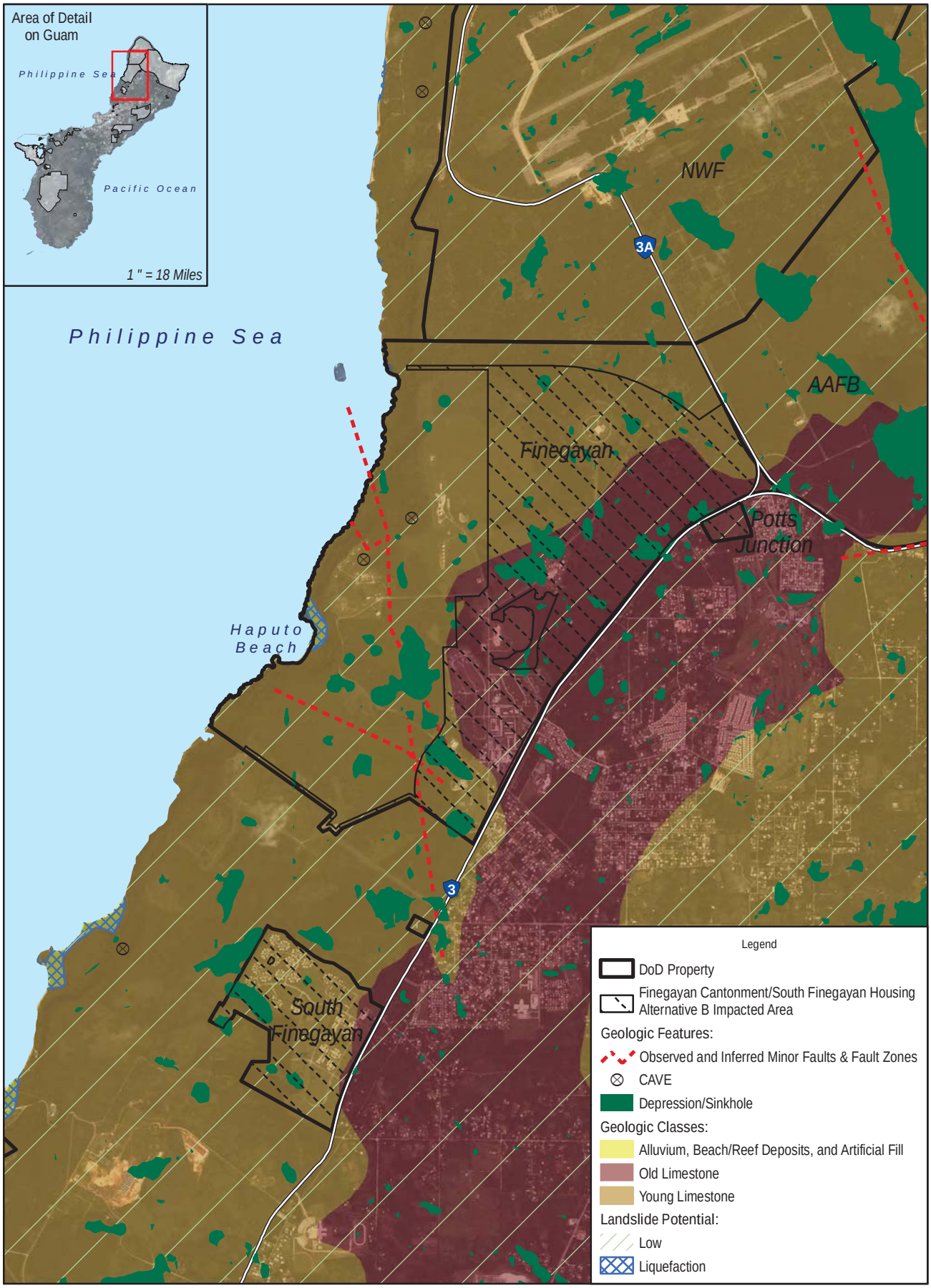


Figure 4.2.1-1
Geologic Features in the Vicinity of Finegayan Cantonment/South Finegayan Housing Alternative B

Sources: COMNAV Marianas 2008; GovGuam 2008; NAVFAC Pacific 2013; Taborosi 2004; WERI 2001

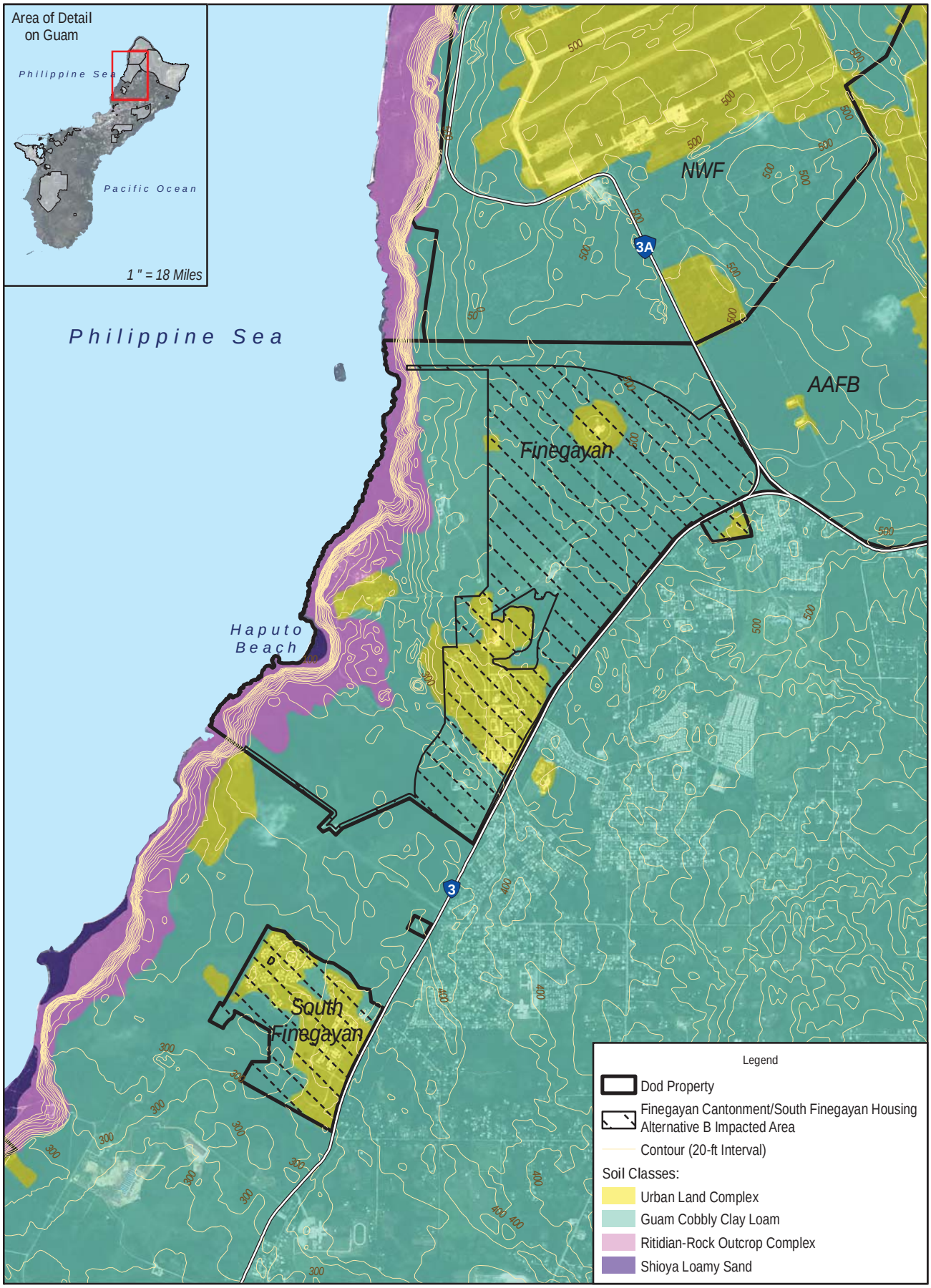


Figure 4.2.1-2
Soils in the Vicinity of Finegayan
Cantonment/South Finegayan Housing Alternative B

Construction

Construction of the new cantonment/family housing, associated support facilities, and roads under Alternative B would include the same activities as described for Alternative A. Earthwork under Alternative B (comprising the Finegayan and South Finegayan components) would include 3,245,000 yd^3 (2,480,980 m^3) of cut (excavation) and 2,731,000 yd^3 (2,087,999 m^3) of fill, resulting in a net of 514,000 yd^3 (392,981 m^3) of cut material available for use as needed. The volume excavated under Alternative B would be in the middle as compared to the other action alternatives (Alternatives D and E would be larger; Alternatives A and C would be smaller). The Alternative B footprint does not include any substantial grade changes such as steep hills or canyons that would be leveled or filled. Similar to Alternative A, only relatively minor changes in grade are anticipated to provide a buildable surface for construction of buildings, parking lots, and roadways associated with Alternative B. Because construction for Alternative B does not involve major elevation changes and would not substantially alter the surrounding landscape, affect important geologic features, or diminish slope stability, there would be less than significant direct, long-term impacts to topography and slope stability, as with Alternative A.

Under Alternative B, the same construction activities would take place as for Alternative A, in similar geologic, soil, and seismic conditions. The only difference is that under Alternative B, less construction/ development (approximately 320 acres [130 ha]) would occur in a previously undeveloped area. The soil types that would be disturbed would not be prime farmland as identified by the USDA. The same BMPs described for Alternative A would be implemented for Alternative B. Therefore, under Alternative B, the construction impacts would be similar to Alternative A: there would be less than significant direct, short-term impacts to soils from erosion and no direct or indirect impact to agricultural soils. Given compliance with 22 GAR Chapter 10 § 10106F, there would be no adverse impacts to sinkholes and direct short-term impacts to sinkholes would be less than significant. In addition, direct and indirect short-term impacts associated with geologic hazards would be less than significant.

Under Alternative B, construction of the utility and school expansions that are common to all alternatives would comprise the same activities, and would occur in the same geologic, soil, and seismic conditions as for Alternative A. The same BMPs described for Alternative A would be implemented for Alternative B. Therefore, under Alternative B, the construction impacts of these components would be similar to Alternative A.

Operation

Under Alternative B, the same residential, recreational, commercial, and administrative uses would take place in the Finegayan and Finegayan South parcels as for Alternative A, under similar geologic, soil and seismic conditions. No prime farmland is identified within the Alternative B project footprint, so there would be no direct or indirect impact to agricultural soils as a result of Alternative B operations. The same erosion minimization measures, sinkhole BMPs and seismic design requirements described for Alternative A would apply to Alternative B. Therefore, with the operation phase of Alternative B there would be no direct or indirect long-term impacts to topography and slope stability, and less than significant direct long-term impacts to soils from erosion. Given compliance with 22 GAR Chapter 10 § 10106F, there would be no adverse impacts to sinkholes. This would minimize potential geologic hazards associated with sinkholes and reduce potential direct long-term impacts to sinkholes to less than significant. Direct and indirect long-term impacts associated with geologic hazards would be less than significant.

Under Alternative B, operation of the utility and school expansions that are common to all alternatives would comprise the same activities, and would occur in the same geologic, soil and seismic conditions as for Alternative A. The same BMPs described for Alternative A would be implemented for Alternative B. Therefore, under Alternative B, the operational impacts of these components would be similar to Alternative A.

4.2.2 Water Resources

4.2.2.1 Affected Environment

Water resources under Alternative B is very similar to that for Alternative A and is described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.1.2.2: Finegayan, pages 4-26 to 4-27), with proposed housing located at South Finegayan farther inland from the coast. The affected environment for the proposed approximately 11 new wells, school expansions, and off-site utilities that are common to all cantonment/family housing alternatives would be the same as described under Alternative A in Section 4.1.2.1 of this SEIS.

Surface Water

As indicated in the 2010 Final EIS, there are no surface water resources in the Finegayan and South Finegayan project area or the utility corridor to AAFB. Surface water for Finegayan is described in Section 4.1.2.1 of this SEIS. Stormwater flows generally from northeast to southwest across the area and ultimately enters the subsurface karst limestone structure through sinkholes and depressions (Figure 4.2.2-1). Existing impervious areas on the Finegayan/South Finegayan project area amount to approximately 150 acres (61 ha), or about 10% of the proposed Finegayan/South Finegayan impacted area of 1,450 acres (587 ha). There are no 100-year or 500-year flood zones identified within the proposed Finegayan/South Finegayan impacted area (Figure 4.2.2-1).

Groundwater

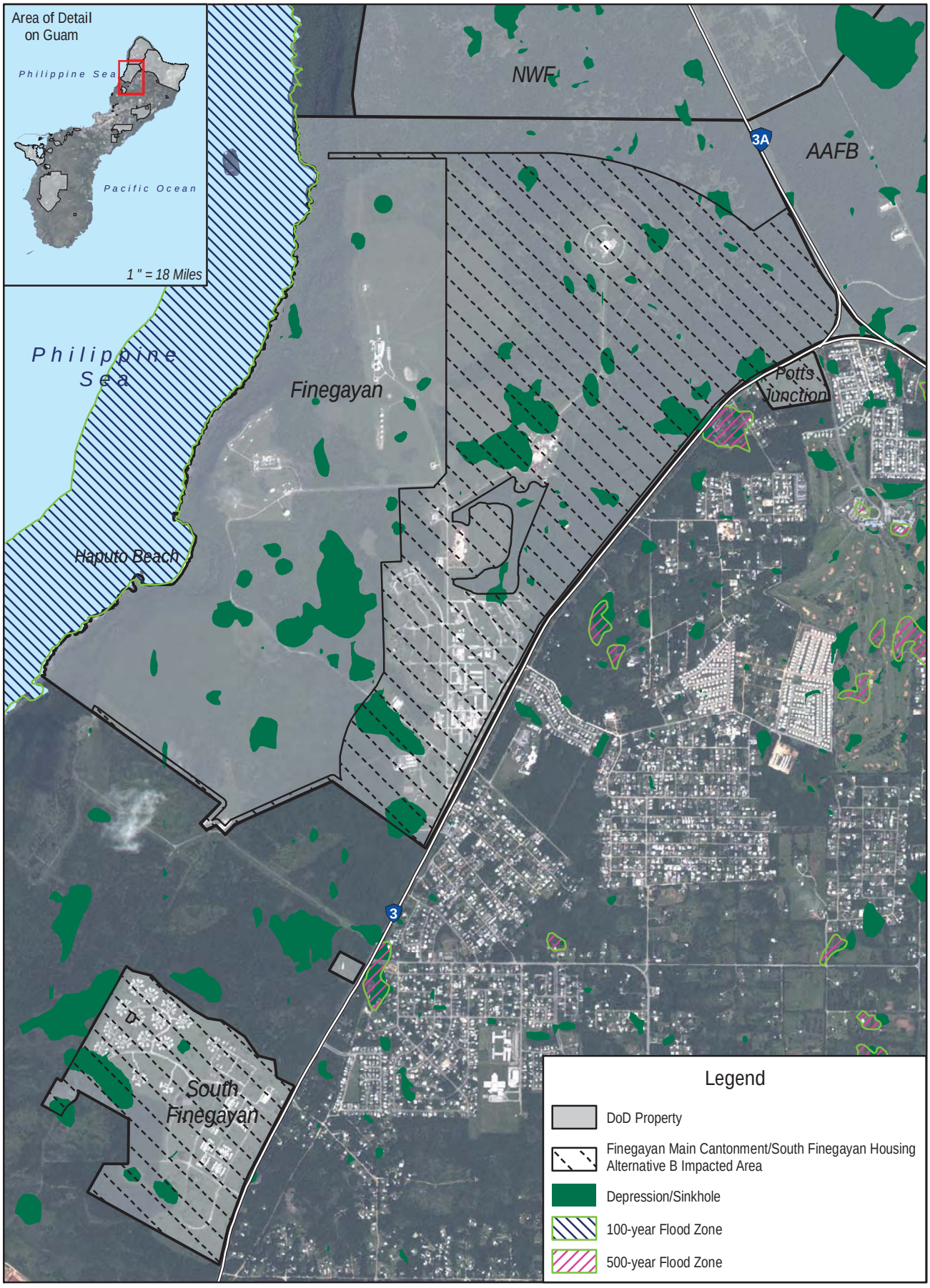
As indicated in the 2010 Final EIS, the Finegayan project area and the utility corridor to AAFB overlie the Finegayan and Agafa-Gumas basins of the NGLA. The circumstances concerning the groundwater model developed by the USGS, the current well production, and the existing GWA interceptor sewer system are the same as described under Alternative A in Section 4.1.2.1 of this SEIS.

Nearshore Waters

As indicated in the 2010 Final EIS, nearshore waters at Finegayan include Haputo Beach and are classified as having M-1 water quality, the use of which is primarily recreational (Figure 4.2.2-1). The Finegayan/South Finegayan project area would be served by the Northern District WWTP, which discharges into the Philippine Sea near Tanguisson Beach (see description under Alternative A in Section 4.1.2.1 of this SEIS).

Wetlands

As indicated in the 2010 Final EIS, no wetlands were identified at the Finegayan/South Finegayan project area or the utility corridor to AAFB.



0 0.2 0.4 Miles

0 0.2 0.4 Kilometers

Figure 4.2.2-1
Water Resources in the Vicinity of Finegayan Cantonment/South Finegayan Housing Alternative B

Sources: WERI 2001; FEMA 2007; NAVFAC Pacific 2013

4.2.2.2 Environmental Consequences

Construction

General construction impacts to water resources would be similar to those described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-84 to 4-88) and under Alternative A in Section 4.1.2.2 of this SEIS. Construction impacts associated with the proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities common to all cantonment/family housing alternatives would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be no impacts to surface water, nearshore waters, and wetlands and less than significant short-term direct impacts to groundwater for these common elements.

In addition, there would be construction activities associated with the proposed Alternative B and the utility corridor to AAFB under Alternative B. Similar to Alternative A, Alternative B would occur in an area that does not contain waters of the U.S. but would comply with the Construction General Permit as described under Alternative A.

Construction under Alternative B would result in the potential for short-term increases in stormwater runoff and erosion. However, through compliance with the Construction General Permit and Program SWPPP and implementation of a site-specific SWPPP and associated erosion control, runoff reduction, and sediment removal BMPs (see Table 4.1.2-2), these effects would be minimized and off-site transport of stormwater runoff would be unlikely except during extreme weather events (i.e., typhoons). Specifically, the site-specific SWPPP would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flow rate of runoff and thereby minimize transport of suspended sediment through settling and promote infiltration of runoff.

Surface Water

No buildings/structures would be constructed in the 100-year or 500-year flood zones and no surface waters are located within or near the proposed construction areas under Alternative B. Given compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely. Therefore, construction activities associated with Alternative B would result in no impacts to surface waters.

Groundwater

Construction activities under Alternative B would include stormwater runoff protection measures that would also serve to protect groundwater quality. By adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific water resource protection requirements, there would be a reduction in stormwater pollutant loading potential and thus a reduction in pollution loading potential to the underlying groundwater basins of the NGLA. As described under Alternative A, an environmental and hydrogeologic assessment for the selected alternative would be performed for sinkholes within the project development footprint to ensure adverse effects to groundwater resources would not occur. Impacts associated with the induced civilian growth and construction/DoD workforce demand on potable water and the construction of the proposed approximately 11 new wells at AAFB would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS.

Potential increases in the rate of sewage spills associated with the induced civilian growth and construction/DoD workforce would result in significant indirect impacts to groundwater quality as described under Alternative A in Section 4.1.2.2 of this SEIS. Mitigation for these impacts would be the same as described in Section 4.1.2.2 for Alternative A.

Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs), the environmental and hydrogeologic assessment for sinkhole protection (if encroachment is unavoidable), siting and construction of wells in accordance with GEPA regulations, minimal increase in water demand or withdrawal from the NGLA during the construction phase, and DoD assistance in identifying funding to upgrade sewer lines, construction activities associated with Alternative B at Finegayan and South Finegayan would result in less than significant short-term direct impacts to groundwater.

Nearshore Waters

General construction impacts to nearshore waters would be similar to those described under Alternative A in Section 4.1.2.2 of this SEIS. The Finegayan/South Finegayan cantonment/family housing project area would be located between 0.5 and 1 mile (0.8 and 1.6 km) from nearshore waters. Given compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely (see discussion of BMPs under *Construction*). The construction area would be approximately 2,600 feet (800 m) from the edge of the cliffline, with another approximately 440 feet [134 m] from the cliffline to the Haputo Bay shoreline. In addition, the Haputo ERA Management Plan requires a no construction buffer of 100 feet (30 m) from the ERA boundary. Beyond the no-construction buffer zone, there would be a 200-foot (60-m) buffer zone where landscaping, fencing, and mowing would be allowed. The vegetative cover over this distance would provide a substantially greater additional buffer and protection from stormwater runoff or sediment reaching Haputo Bay under Alternative B than under Alternative A, which would have a buffer of only approximately 540 feet (160 m) between the construction area and the shoreline. Given adherence to the provisions of the Construction General Permit and implementation of BMPs, it is expected that stormwater runoff, sediment, or other pollutants would not discharge to nearshore waters.

Induced civilian and construction/DoD workforce growth during construction of the cantonment/family housing facilities under Alternative B would increase demand for wastewater treatment at the Northern District WWTP and disposal of generated wastewater. Due to the reduced population projection and related smaller increase in demand under the 2012 Roadmap Adjustments, this increase in wastewater discharge from the Northern District WWTP would be less than under the No-Action Alternative. However, as discussed in Section 4.1.14, Utilities in this SEIS, upgrades to the Northern District WWTP are already needed for the plant to achieve compliance with the treatment standards required by its current NPDES permit. Increasing the wastewater discharge from a non-compliant treatment plant could result in significant indirect impacts to nearshore waters during the period of non-compliance. The significance of nearshore waters impacts resulting from implementation of Alternative B would be similar to that associated with implementing Alternatives A, C, D and E. Mitigation for these impacts would be the same as described in Section 4.1.2.2 for Alternative A.

Therefore, with the mitigation to upgrade the Northern District WWTP treatment systems, the impact to nearshore waters could be beneficial in the long-term because the total volume of wastewater discharge from the Northern District WWTP would receive a higher level of treatment. However, until the WWTP upgrades are completed there would be an indirect and unmitigable significant impact to nearshore waters during construction.

Wetlands

No wetlands are located in or near the construction areas associated with Alternative B. Therefore, construction activities associated with Alternative B would result in no impacts to wetlands.

Operation

Alternative B would incorporate a LID approach in the final planning, design, and construction of the stormwater management system as described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-85 to 4-87) and under Alternative A in Section 4.1.2.2 of this SEIS. Operation impacts associated with the proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities common to all cantonment/family housing alternatives would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be no impacts to surface water, nearshore waters, and wetlands and less than significant direct and indirect long-term impacts to groundwater for these common elements.

The proposed stormwater management system infrastructure improvements included as part of the proposed action would incorporate LID measures and BMPs for compliance with local and federal requirements that are designed to minimize potential impacts to downstream development, sensitive water resources, and ecology, as described under Alternative A in Section 4.1.2.2 of this SEIS. Alternative B would also be implemented in accordance with all applicable orders, laws, and regulations including the preparation and implementation of a SWPPP, SWMP, and SPCC plan that would control runoff and minimize potential leaks and spills.

Under Alternative B, the total impervious area on the Finegayan and South Finegayan project area would increase by 176 acres (71 ha). This increase from 10% to 22% impervious area, for a total of 326 acres (132 ha), would result in an associated increase in stormwater runoff volume for each of the design storm events. The utility corridor to AAFB would result in minimal increase in impervious area. Alternative B would result in increased runoff of 332 acre-feet (408,900 m^3) and 412 acre-feet (508,200 m^3) from the 25-year and 100-year design storms, respectively. However, the project design would include vegetated swales for conveyance and treatment and detention/retention ponds capable of capturing, storing, and treating additional runoff from the 25-year design storm (see Appendix F for examples of LID applications that would be used and conceptual design of stormwater runoff routing and pond locations). As part of the planning design, the project area was delineated into sub-basins with stormwater conveyance systems to route discharges to appropriately sized detention basins. For each sub-basin, water quality treatment strategies were selected based on the effectiveness of BMPs to treat identified pollutants of concern from proposed land uses within that sub-basin. The selected water quality treatment strategies would achieve reductions of non-point source pollutants to meet the same water quality requirements as identified under Alternative A in Section 4.1.2.2 of this SEIS. In addition, DON would develop and implement a "LID BMP O&M Inspection Checklist" consistent with the 2006 CNMI Guam Stormwater Management Manual to monitor and ensure the effectiveness of LID features during operation. Any deficiencies would be reported to and addressed by the future Public Works Department of the Marine Corps Base Guam.

The final Grading/Drainage/LID Study, dated July 2013, would be provided to the design team for guidance and implementation during design and construction. The designs performed by these contractors would be subject to review by DoD professionals and technical consultants to ensure proper implementation both during design and verification during construction.

Surface Water

No surface waters are located in or near the Alternative B project area and the implementation of an appropriate and comprehensive stormwater management plan utilizing a LID approach would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event. Therefore, Alternative B would result in no impacts to surface waters.

Groundwater

Under Alternative B, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would also serve to protect groundwater quality and recharge. Specifically, implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that the stormwater runoff flowing into infiltration basins and recharging the aquifer would be of acceptable quality.

Compared to Alternative A, there would be less removal of secondary limestone forest (i.e., approximately 650 acres [260 ha] for Alternative B vs. 1,000 acres [400 ha] for Alternative A) and less area would be converted to impervious area (i.e., approximately 176 acres [71 ha] for Alternative B vs. 273 acres [110 ha] for Alternative A). Similar to Alternative A, these changes in land cover and impervious area under Alternative B would also result in minor changes to groundwater recharge rates. However, these changes in land cover and impervious area were accounted for during the development of a conceptual level of design for grading, drainage, and LID measures, and projected changes in recharge rates would be managed through updating the USGS numerical groundwater model to determine modifications to groundwater pumping, as described under Alternative A. Increased groundwater withdrawal would also be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be short-term, localized significant impacts to the affected basin within the NGLA but less than significant impacts to the overall NGLA. Potential mitigations would be the same as described for Alternative A in Section 4.1.2.2 of this SEIS.

Given stormwater runoff protection measures (i.e., implementation of LID and pollution prevention plans); implementation of water conservation measures; groundwater demand from the NGLA that would be substantially less than the sustainable yield; improved management of the NGLA through use of the numerical groundwater model; DoD assistance in identifying funding through the EAC process for an updated and expanded monitoring network; and other potential mitigation measures discussed above, operations associated with Alternative B would result in less than significant impacts to the overall NGLA; short-term, localized significant but mitigable impacts from groundwater extraction to the affected basin within the NGLA; and significant but mitigable impacts to groundwater quality from increased flow through the deteriorating GWA interceptor sewer system.

Nearshore Waters

Under Alternative B, proposed operations would be in compliance with the stormwater protection measures identified above that would ensure that there would be no increase in off-site transport of stormwater runoff, sediment, or other pollutants to nearshore waters for up to the 25-year design storm event. In addition, the vegetative cover between the housing area and the cliff edge and Haputo Bay under Alternative B (approximately 2,600 feet [800 m]) would provide a substantially greater additional buffer and protection from stormwater runoff or sediment reaching Haputo Bay than under Alternative A, which would have a buffer of only approximately 36 feet (11 m) between the construction area and the edge of

the steep cliff. Therefore, there would be no direct or indirect long-term impacts to nearshore waters from stormwater runoff associated with increased impervious areas under Alternative B.

Water resources would be impacted by the increased wastewater discharge from the Northern District WWTP for treatment and disposal of generated wastewater for the operation of cantonment/family housing at Finegayan/South Finegayan. The associated potential impacts and mitigation would be similar to those described under construction. Refer to construction impacts above for a detailed discussion of WWTP discharge impacts and mitigation.

Wetlands

No wetlands are located in or near the proposed operational areas under Alternative B. Therefore, operations associated with Alternative B would result in no impacts to wetlands.

4.2.3 Air Quality

4.2.3.1 Affected Environment

The affected air quality environment under Alternative B is the same as described under Alternative A. Therefore, the information contained in Section 4.1.3 is applicable to Alternative B, with differences discussed in this section. The proposed housing areas on South Finegayan are within the SO_2 nonattainment area covered by the 2.2-mile (3.5-km) radius around the Tanguisson Power Plant. It is also close to Route 3 traffic that is the dominant source of mobile source emissions.

4.2.3.2 Environmental Consequences

Construction

Annual Emissions

The construction phase annual emissions are summarized in Table 4.2.3-1. Annual direct emissions for criteria pollutants would be short-term and well below the significance criterion of 250 tpy, as shown in Table 4.2.3-1. The CO_2 emissions during construction period would be less than those analyzed in the 2010 Final EIS resulting in less GHG impacts as compared to the No-Action Alternative.

Table 4.2.3-1. Finegayan Cantonment/South Finegayan Housing Annual Construction Emissions (2016-2022)

Construction	***Pollutant (tpy)***						
Year (Percent Activity)	***SO_2***	***CO***	***PM_{10}***	***$PM_{2.5}$***	***NO_x***	***VOC***	***CO_2***
2016	neg	neg	neg	neg	neg	neg	neg
2017	0.0	0.6	0.0	0.0	0.4	0.1	96.6
2018	0.3	20.1	1.2	1.1	15.6	2.1	3457.6
2019	0.6	36.5	2.2	2.0	28.4	3.8	6269.3
2020	0.2	9.5	0.6	0.5	7.4	1.0	1627.0
2021	0.8	45.9	2.8	2.5	35.6	4.7	7882.8
2022	0.2	13.6	0.8	0.7	10.6	1.4	2332.6

Legend: SO_2 = sulfur dioxide; CO = carbon monoxide; PM_{10} = particulate matter (<10 microns); $PM_{2.5}$= particulate matter (<2.5 microns); NO_x= nitrogen oxides; VOC= volatile organic compounds; CO_2 = carbon dioxide; neg = negligible.

General Conformity Applicability

Because the South Finegayan housing area is within the Tanguisson SO_2 nonattainment area, annual construction phase emissions associated with the South Finegayan housing development are required to be analyzed for purposes of the CAA General Conformity Rule applicability analysis. Since the emissions from the entire cantonment project including South Finegayan housing construction activities would not

exceed the applicable *de minimis* level of 100 tpy for SO_2 (see Table 4.2.3-1), the formal general conformity determination is not required.

On-Site Equipment and Vehicle PM Hot-Spot Analysis

As compared to Alternative A, the construction activity areas are split into Finegayan and South Finegayan, as depicted in Figure 4.2.3-1. Given the close proximity of the South Finegayan housing area to some of the off-site receptors along Route 3, similar on-site construction activity PM hot-spot impact modeling was conducted using the same procedures as described under Alternative A with the modeling configuration shown in Figure 4.2.3-1.

The same modeling procedures discussed in Section 4.1.3 were employed in the analysis. Table 4.2.3-2 shows the predicted total worst-case concentrations for PM (PM_{10} and $PM_{2.5}$) from the contributions of: (1) on-site construction activities, and (2) worst-case off-site location on-road vehicle exhausts evaluated under the Alternative A in addressing potential MSAT impacts. The total PM levels predicted are well below respective NAAQS, resulting in less than significant direct, short-term PM impacts during construction years. Since the PM modeled includes diesel particulate as part of MSATs, the predicted PM levels that are well below the health-based NAAQS are also indicators that on-site construction activities would result in less than significant MSAT impacts during construction years.

Table 4.2.3-2. Total Construction Period PM Concentrations

Source Contributions	***24-hour Average PM_{10} ($\mu g/m^3$)***	***24-hour Average $PM_{2.5}$ ($\mu g/m^3$)***	***Annual Average $PM_{2.5}$ ($\mu g/m^3$)***
On-site Construction Activity	2.18	0.57	0.02
Off-site Mobile Source [1]	0.47	0.47	0.12
Total	**2.65**	**1.04**	**0.14**
NAAQS	150	35	12

Note: [1]Based on the worst-case modeling results for total diesel particulate concentrations performed as part of off-site MSAT analysis under Alternative A.

Off-Site On-Road Vehicle Hot-Spot Analysis for CO, PM, and MSATs

Off-site on-road vehicle CO, PM, and MSATs hot-spot impact concentrations for Alternative B would be similar to those predicted for Alternative A (see Section 4.1.3.2) at the analyzed intersections. This comparison is based on a review of similar traffic congestion patterns during the construction period along the similar main truck routes used under both this alternative and Alternative A. The concentration levels of PM and CO predicted under Alternative A as shown in Tables 4.1.3-3 and 4.1.3-4, are well below their respective NAAQS. Therefore, the hot-spot concentration levels under Alternative B, would be well below the NAAQS; resulting in less than significant direct, short-term PM and CO impacts.

Similarly, off-site on-road vehicle MSATs concentration levels would be comparable to those predicted under Alternative A, as shown in Tables 4.1.3-6 and 4.1.3-7, with the comparison of cancer and non-cancer risks. Therefore, the project impacts of all non-carcinogenic MSATs are considered acceptable.

Based on these findings, construction phase direct air quality impacts under Alternative B are considered short-term and less than significant.

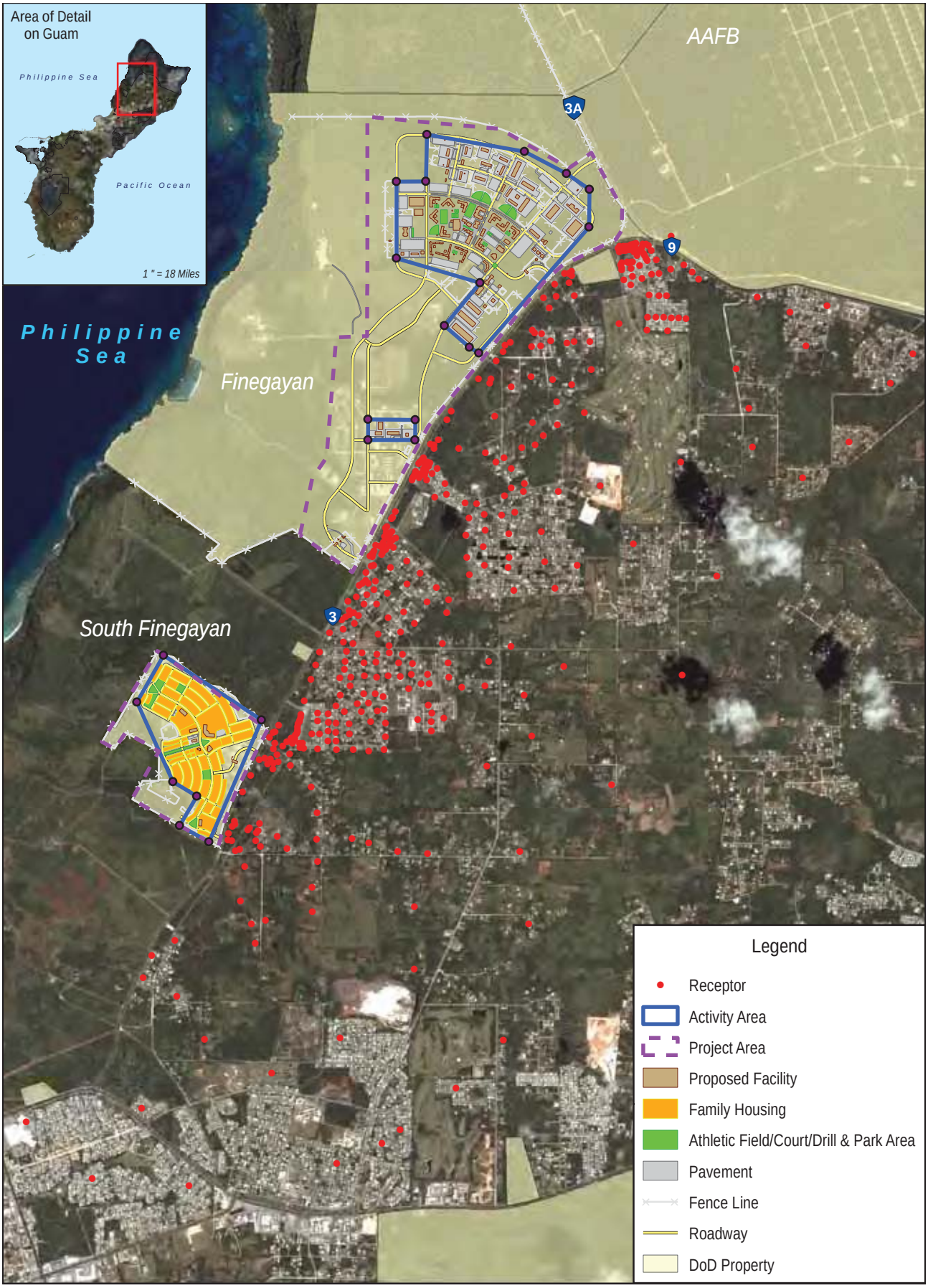


Figure 4.2.3-1

PM Modeling Configuration - Alternative B

Operation

As discussed in Section 4.1.3, a total of six worst-case intersections covering the roadway network in northern, central, and southern Guam were selected through the screening process for further hot-spot analysis of potential worst-case CO and MSATs impacts, and it was found that at the analyzed hot-spot concentrations CO and MSATs would be well below the corresponding impact thresholds.

A comparison of traffic congestion conditions, in terms of delay and LOS (A, B, C, D, E, and F; ranging from "no congestion" to "worst congestion") at these analyzed intersections under Alternative B and Alternative A, is provided in Table 4.2.3-3. The congestion conditions under Alternative B would be comparable to, but slightly worse than, Alternative A. Given the low levels of CO and MSATs impact concentrations predicted under Alternative A, the hot-spot impact of off-site on-road vehicle CO and MSATs emissions during operational years would be similar for this alternative as for Alternative A, based on the traffic conditions at the intersections analyzed for this alternative. Based on these findings, direct and indirect long-term operational phase air quality impacts under Alternative B are considered less than significant.

Table 4.2.3-3. Comparison of Traffic Congestion Condition

Site #	*Worst-case Intersection in Northern, Central, and Southern Guam*	*Alternative B*		*Alternative A*	
		Delay (second)	*Level of Service*	*Delay (second)*	*Level of Service*
1	Route 3/9/Chalan Santa Anita	35.9	E	34.5	D
2	Route 1 / Route 3	99.8	F	90.1	F
3	Route 16 / Route 27	166.2	F	159.0	F
4	Route 1 / Route 14A	>180.0	F	> 180.0	F
5	Route 10 / Route 15	35.1	D	34.6	C
6	Route 1 / Route 2A	23.2	C	23.2	C

4.2.4 Noise

4.2.4.1 Affected Environment

With respect to the evaluation of potential noise impacts, the affected environment for implementation of Alternative B is very similar to that described in Alternative A. The quantified noise impacts around AAFB from the 2010 Final EIS (Volume 2, Chapter 6: Noise, Section 6.2.2: Alternative 1, page 6-26) are used as the baseline noise levels to assess the amount of area potentially affected by noise (see Table 4.1.4-1).

According to the 2013 AAFB AICUZ Study, noise contours greater than 65 dBA do not reach South Finegayan. Noise generated from aircraft approach traffic to AAFB bisects the Finegayan area. Residents along Route 3 adjacent to the Finegayan cantonment area and South Finegayan experience aircraft noise of less than 65 dB under baseline conditions, respectively.

4.2.4.2 Environmental Consequences

Construction

The cantonment portion of this alternative would be similar to that of Alternative A. However, family housing would be located in South Finegayan instead of the location adjacent to Haputo Bay in Alternative A. The Finegayan location would be open space for potential future development. As such, noise impacts due to construction of the cantonment area would be the same as described in Section 4.1.4.2.

Construction noise impacts at South Finegayan would also be similar because the residences are also approximately 500 feet (152 m) from the average receptor with Route 3 frontage, and noise levels would be 65.4 dBA L_{eq}. However, 10 additional houses would be affected involving approximately 36 additional people (based on average household size estimates for Guam).

Short-term construction noise would be below the 75 dBA daily USEPA threshold guidelines for construction. Similar to Alternative A, the construction schedule for implementing the proposed action would be spread out. Sequencing work tasks allowing only one or two pieces of heavy equipment operating in areas close to the nearest receptors would lessen the noise impacts. Long-term noise under this alternative would be the same as Alternative 1 except family housing would be located closer to receptors along Route 3. The center of the family housing would be approximately 1,700 feet (518 meters) from Route 3 and long-term noise levels would be about 58 dBA and well less than the FICUN criteria. Consequently, short-term and long-term noise impacts (direct and indirect) would be less than significant for Alternative B.

Construction activities common to all alternatives include off-site utilities and school expansions. Direct and indirect impacts due to these common construction projects would be as described in Section 4.1.4.2 and would be less than significant.

Operation

Operations and traffic noise would be similar to that describe for Alternative A. The only difference would be slightly more traffic noise in the 1 mile (1.6 km) stretch of Route 3 between the South Finegayan housing gate and the family housing gate for Alternative A. However, no houses would be affected by noise levels greater than 66 dB. Noise impacts (direct and indirect) would be less than significant because noise levels would be below GDPW standards.

4.2.5 Airspace

4.2.5.1 Affected Environment

Operations and functions associated with Alternative B facilities consist of support, maintenance/storage, housing, and non-live fire training functions (see Section 2.2.1). There would be no construction or operation activities requiring changes to airspace. Therefore, the affected environment for airspace is only discussed in the context of the LFTRC components of the proposed action (see Chapter 5 of this SEIS).

4.2.5.2 Environmental Consequences

As stated above, there would be no construction or operation activities requiring changes to airspace. Therefore, there would be no impact on airspace from this component of the proposed action.

4.2.6 Land and Submerged Land Use

4.2.6.1 Affected Environment

The affected environment for land use associated with Alternative B is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.1: Affected Environment, pages 8-25 to 8-27), which is summarized below for reference. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for land use.

The Finegayan and South Finegayan parcels are federal lands and non-contiguous. They are separated by an area referred to as the former FAA parcel (Figure 4.2.6-1). The former FAA parcel is currently owned by GovGuam and private landowners (see Figure 4.1.6-1). Finegayan land/submerged land ownership and land use is as described in Section 4.1.6. There is no coastline or submerged land associated with the South Finegayan parcel.

GovGuam lands are located between Finegayan and South Finegayan, and east of South Finegayan and Route 3 (Figure 4.2.6-1). Private lands are adjacent to the west (formerly referred to as a GLUP 77 parcel, released by the federal government in 2011 subsequent to the 2010 Final EIS) and south (formerly referred to as the Harmon Annex). The South Finegayan parcel is used for DON family housing.

The land use of the former FAA, GLUP 77 and Harmon Annex parcels is primarily vacant and naturally vegetated with evidence of former development. There is a jogging path within the former FAA parcel that is used by the public. Route 3 and residential communities are located to the east of Route 3 (see Figure 4.2.6-1). The planned land use in this area is Mixed Use. The Dos Amantes Planning Area includes areas adjacent to the parcel to the north, west and south, all of which currently appear vacant (i.e., no modern manmade structures) and naturally vegetated in areas adjacent to South Finegayan. Younex has constructed temporary workforce housing south but not adjacent to South Finegayan. In the Dos Amantes Planning Area, the areas north (former FAA parcel) and west of the South Finegayan parcel are planned Hotel/Resort. The area south of the parcel boundary is partially planned Urban Center with Commercial land use planned along Route 3. Lands east of the South Finegayan parcel and Route 3 are designated Mixed Use in the *North and Central Guam Land Use Plan* (GBSP 2009) (Figure 4.2.6-1). Latte Stone Park is an important land use-related resource located within the housing development area of South Finegayan (see Sections 4.2.7 and 4.2.10 for additional discussion).

4.2.6.2 Environmental Consequences

Land use impacts are addressed in this section. Land ownership impacts are addressed in Section 4.2.15, Socioeconomics and General Services.

Construction

As previously discussed in Section 3.6.3.1, Methodology, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource under any of the alternatives.

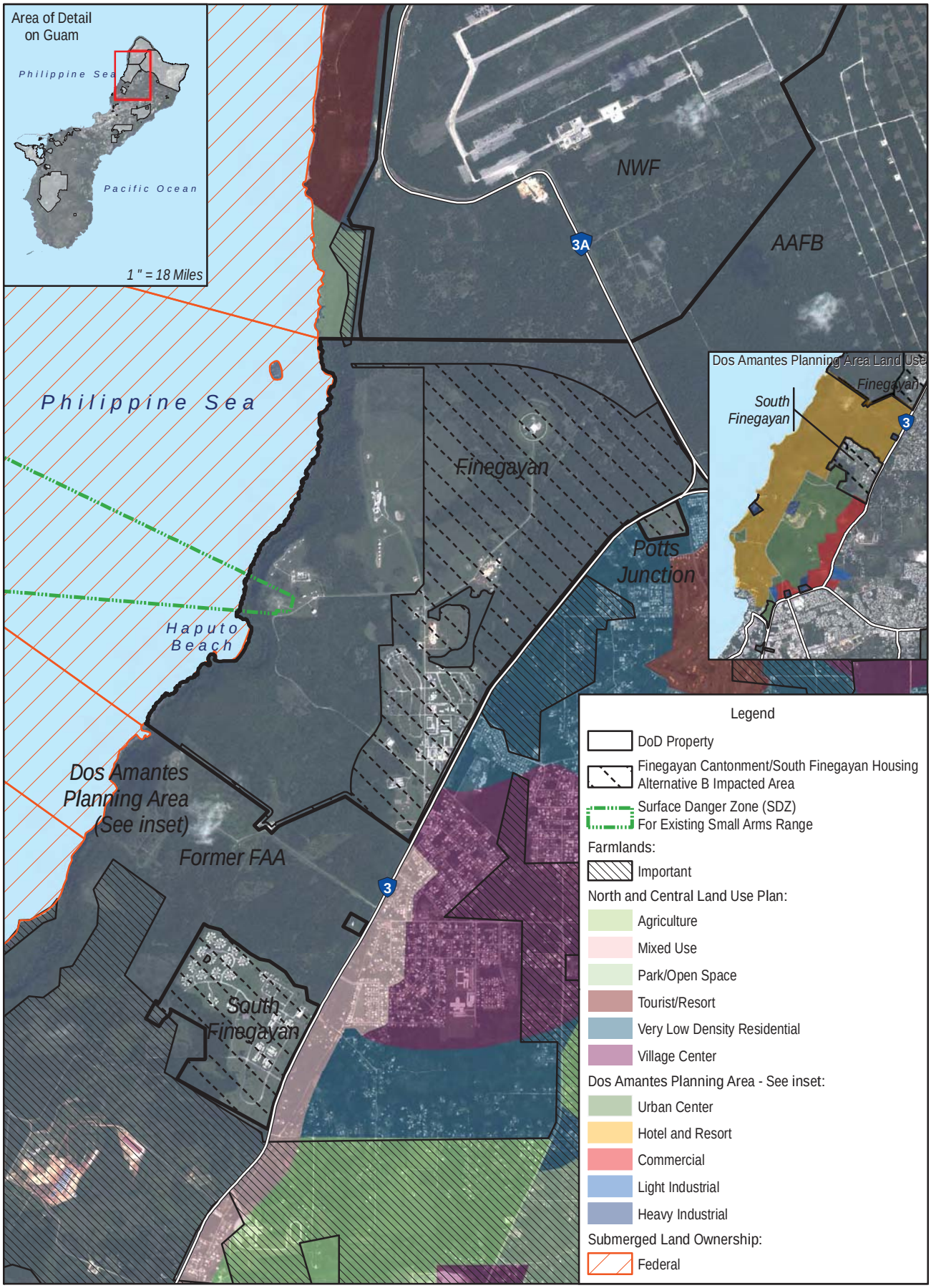


Figure 4.2.6-1
Land Use in the Vicinity of Finegayan
Cantonment/South Finegayan Housing Alternative B

Sources: DON 2010, NAVFAC Pacific 2013

Operation

The proposed action is limited to the federally owned Finegayan and South Finegayan parcels, except for the education facility and off-base utility improvements. All cantonment alternatives require water well development on AAFB. The affected environment and environmental consequences are described in Section 4.3.6, AAFB Cantonment/Family Housing - Alternative C. No impact to this resource is anticipated.

The proposed expansion of existing education facilities and the off-base utilities common to all alternatives are as described under Section 4.1.6, and no impact is anticipated. The off-base utility improvements specific to this alternative are similar to those described for the Finegayan alternative but the underground utility lines would extend further south along Route 3 between Finegayan and South Finegayan. There would be no impact on land use resulting from the off-base utility improvements. However, additional inter-base IT/COMM connectivity would be required as described in Chapter 2. This includes the connection between AAFB and the existing Tata cable landing facility in southern Guam, which would require new rights of way along some southern roads and the access road to the Tata facility.

The potential land use impacts for the Finegayan parcel are described in Section 4.1.6, except the family housing would be located at South Finegayan and not at Finegayan. More open space would remain at Finegayan under this alternative than the Finegayan only alternative (Alternative A). The South Finegayan parcel land use would continue to be used for housing and community support but at a greater density under Alternative B. Open space is incorporated into the proposed action site plan but there would be less open space than currently exists at the parcel. The maximum height of the housing buildings would be two stories. The decrease in open space would be a less than significant impact on the community adjacent to the base.

The planned Dos Amantes Hotel/Resort, Residential and Commercial areas that are located adjacent to the Finegayan and South Finegayan parcels would be compatible with the proposed cantonment/family housing development. The planned mixed use and residential areas west of Route 3 are also compatible with this action alternative. Impacts associated with ground transport between the two parcels are addressed in Section 4.2.12.

As mentioned in Section 4.2.7, public access to Latte Stone Park would be restricted. The new restriction is a potentially direct short and long-term significant impact on public access. To mitigate this impact to a less than significant level, DoD would work with the local community to provide access to Latte Stone Park to the extent practicable. The recreational impacts and measures to address cultural resources in the park are described in Sections 4.2.7 and 4.2.10, respectively. Due to this potential for significant mitigable impacts to land use resources, Alternative B would have a higher level of land use impact than the other cantonment/family housing alternatives (Alternatives A, C, D, and E).

4.2.7 Recreational Resources

4.2.7.1 Affected Environment

Recreational resources near Alternative B are the same as those discussed for Alternative A in Section 4.1.7. In addition to the recreational resources discussed in Section 4.1.7, South Finegayan contains Latte Stone Park, which is an important Chamorro cultural and historic site located within the housing development area of South Finegayan. Latte Stone Park is currently open to the public. Table 4.2.7-1 identifies the recreational resources near Alternative B.

Table 4.2.7-1. Recreational Resources in the Vicinity of Alternative B

Recreational Resource	***Public Access (Current Status - Future access may change under the JRM Public Access Program required by the 2011 PA)***
Trails	
Haputo Trail, Double Reef Beach Trail	Installation personnel and guests only
Dive Spots	
Double Reef	Open to public via sea access
Shark's Hole	Open to public via sea access and Tanguisson Beach
Beaches and Parks	
Guam NWR	Installation personnel and guests only (with the exception of the Ritidian Unit, which is open to the public)
Latte Stone Park	Open to public

Source: DON 2010.

4.2.7.2 Environmental Consequences

Construction

The short-term increase of construction-related vehicles on roads may cause delays to persons accessing recreational areas. Staged construction equipment would not obstruct access to, or the use of, the recreational resources. However, resource users may be inconvenienced by potential detours, longer waits, and other similar nuisances. The impacts of implementing Alternative B would be similar to that of Alternative A. Therefore, there would be less than significant short-term impacts to recreational resources.

Operation

The impacts to recreational resources would be substantially reduced compared to the impacts discussed in the 2010 Final EIS (Volume 2, Chapter 9: Recreational Resources, Section 9.2.2.1: Alternative 1, North, pages 9-21 to 9-22) due to the smaller number of Marines and dependents relocating to Guam. The rate of usage and wear and tear (deterioration) of the recreational resources would be slower due to a lower number of users. Though the scale of the Marine Corps relocation would be reduced, some direct impacts to existing recreational resources would still be anticipated due to the increased population relative to baseline conditions. The status of public access to recreational resources identified in Table 4.2.7-1 may change under the 2011 PA with JRM as part of the 2010 Final EIS. (Note: access restriction impacts on Latte Stone Park are assessed above in Land and Submerged Land Use, Section 4.2.6.2).

It is important to note that recreation is not the primary function of an ERA. One of the management objectives of the ERA management plan (contained in the INRMP) is to fence the eastern boundary of the reserve to prevent unauthorized activities, as well as prevent Philippine deer and feral pigs from accessing the reserve area. Some direct impact to existing recreational resources would still be anticipated due to the long-term increased population of Marines and their dependents on Guam. However, managing access to

the ERA may minimize potential impacts from the increase in potential users and unauthorized activities (e.g., camping and fires). Operations-phase implementation of this alternative would result in a less than significant direct, long-term impact for the same reasons described above for construction.

Alternative B would have a substantially lower level of potential impacts to recreational resources compared to Alternative D, since Alternative B has less than significant impacts.

4.2.8 Terrestrial Biological Resources

4.2.8.1 Affected Environment

See Section 4.1.8.1 for a description of the affected environment for Finegayan and the AAFB support areas. The following is a discussion of only South Finegayan.

Vegetation Communities

Vegetation communities and acreage at South Finegayan are the same as described in the 2010 Final EIS (Volume 2, Marine Corps Chapter 10: Terrestrial Biological Resources, Section 10.1.3.2: Finegayan, pages 10-34 to 10-35). Although the majority of South Finegayan is developed or actively landscaped, the southwestern portion of the parcel contains secondary limestone forest (see Figure 4.1.8-1).

Terrestrial Conservation Areas

South Finegayan does not contain any terrestrial conservation areas.

Wildlife - Native Species

The 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.2: Finegayan, page 10-39) provides information about native wildlife species present at South Finegayan. Surveys for reptiles were conducted in 2012 within the forested area of South Finegayan and no new species beyond those reported in the 2010 EIS were found (NAVFAC Pacific 2010, 2013a).

Wildlife - Non-Native Species

The 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.2: Finegayan, page 10-39) provides information about non-native wildlife species present at South Finegayan. Surveys for reptiles were conducted in 2012 within the forested area of South Finegayan and no new species beyond those reported in the 2010 EIS were found (NAVFAC Pacific 2010, 2013a).

Special-Status Species: Federal ESA-Listed and Proposed Species

As reported in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.2: Finegayan, page 10-39), the area is primarily a developed housing area and the undeveloped portion contains degraded secondary limestone forest. No ESA-listed or species proposed for listing have been reported during 2010, 2012, and 2013 project-specific surveys at South Finegayan (Table 4.1.8-1) (NAVFAC Pacific 2010, 2013a; UoG 2014). However, the host plant for the ESA proposed endangered species Mariana wandering butterfly has been observed within the area of secondary limestone forest at South Finegayan (see Figure 4.1.8-4) (UoG 2014).

Special-Status Species: Guam-Listed and SOGCN

As reported in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.2: Finegayan, page 10-39), the area is primarily a developed housing area and the undeveloped portion contains degraded secondary limestone forest. No Guam-listed species or SOGCN have been

reported at South Finegayan during 2010 and 2012 project-specific surveys (NAVFAC Pacific 2010, 2013a).

4.2.8.2 Environmental Consequences

Construction

Vegetation. The vegetation communities that would be impacted during proposed facility and infrastructure construction activities under Alternative B are shown within the outlined impact footprint in Figure 4.1.8-1 for the cantonment and housing areas and in Figure 4.1.8-2 for the support areas. The total area of vegetation communities that would be impacted under Alternative B would be similar to that described under Alternative A (Section 4.1.8.2, Table 4.1.8-2), but with an approximate 28 acres (11 ha) less impacted under Alternative B. Under Alternative B, the main vegetation categories that would be impacted would be secondary limestone forest (813 acres [329 ha]) and developed (732 acres [296 ha]) (Table 4.2.8-1). The primary differences between Alternative A and B are that 192 acres (78 ha) less of secondary limestone forest and 197 acres (80 ha) more of developed land would be impacted under Alternative B compared to Alternative A. The proposed housing area under Alternative B would be developed within the existing predominantly developed area of South Finegayan. Approximately 2 acres (0.8 ha) of primary limestone forest would be impacted under both alternatives. Most of the secondary limestone forest that would be impacted (672 acres [272 ha]) is associated with the cantonment component of Alternative A that would be the same cantonment area as under Alternative B (see Figure 4.1.8-1). Approximately 134 acres (54 ha) of other vegetation communities, primarily herbaceous scrub, would also be impacted (Table 4.2.8-1).

Table 4.2.8-1. Direct Impacts to Vegetation Communities at Finegayan, South Finegayan, and Support Areas with Implementation of Cantonment/Family Housing Alternative B

Project Component	*Vegetation Community (acres [ha])*					
	PLF	***SLF***	***HS***	***TT***	***Dev***	***Total***
Finegayan cantonment	0.5 (0.2)	672.1 (272.0)	117.3 (47.5)	2.0 (0.8)	399.0 (161.5)	**1,190.9 (482.0)**
South Finegayan housing	0	70.3 (28.4)	0.4 (0.2)	0	218.5 (88.4)	**289.2 (117.0)**
Utility corridor specific to Alternative B	0.2 (0.1)	13.5 (5.5)	0.1 (<0.1)	0	28.0 (11.3)	**41.8 (16.9)**
Utility corridors and water well areas common to Alternatives A-E	1.3 (0.5)	57.1 (23.1)	9.5 (3.8)	4.5 (1.8)	69.2 (28.0)	**126.3 (51.1)**
High School/Middle School Expansions	0	0	0	0.3 (0.1)	17.2 (7.0)	**17.5 (7.1)**
Total	**2.0 (0.8)**	**813.0 (329.0)**	**127.3 (51.5)**	**6.8 (2.8)**	**731.9 (296.2)**	**1,665.7 (674.1)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; TT = tangantangan; Dev = developed.

Native limestone forest, both primary and secondary, has been significantly reduced on Guam due to past and ongoing actions including extensive disturbance during and after WWII, widespread planting of non-native species; and impacts from non-native ungulates; development; fire; and deforestation. As stated in Section 3.8.1.1, limestone forests are important because they retain the functional ecological components of native forest that provide habitat for the majority of Guam's native species, including ESA-listed, proposed, and Guam-listed species and Guam SOGCN, as well as maintaining water quality and reducing fire risk. Non-native forest communities (e.g., tangantangan, *Vitex*) significantly alter the forest structure, composition, and resilience to other disturbance processes and do not provide the conditions suitable for

native flora and fauna species to persist (Morton *et al.* 2000; GDAWR 2006; Guam Department of Agriculture 2010; JRM 2013).

Of the 18,538 acres (7,502 ha) of primary and secondary limestone forest found on Guam, approximately 13,110 acres (5,305 ha) (or 71%) are found on federal lands, primarily within AAFB, Finegayan and the NAVMAG (USFS 2006). The most intact native limestone forest in the vicinity of the proposed impacted areas is within the Haputo ERA, which would not be impacted from proposed construction activities. Under Alternative B, 2 acres (0.7 ha) of primary limestone forest and 813 acres (329 ha) of secondary limestone forest would be removed, primarily associated with the proposed cantonment at Finegayan (Table 4.2.8-1). Therefore, given the importance of limestone forest habitat for native species and the continuing loss of limestone forest across Guam, the conversion of 815 acres (330 ha) of limestone forest on Finegayan and South Finegayan to developed area under Alternative B would be a significant but mitigable impact to the regional vegetation community and its function.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on vegetation communities with implementation of Alternative B. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the contractor education program.
- *Onsite Vegetation Waste Management Procedures*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the vegetation waste management procedures.
- *DON Guam Landscaping Guidelines*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of landscaping guidelines.
- *Contractor Plans and Specifications*. All construction would occur within the limits of construction shown in the project figures.

Potential Mitigation Measures

To mitigate for significant impacts to limestone forest, the DON proposes to implement forest enhancement on a minimum of 815 acres (330 ha) of limestone forest. Forest enhancement would include but is not limited to the following actions:

- Ungulate management consisting of exclusion fencing and active control (i.e. trapping, snaring, shooting) with the goal of eradication within the fenced areas.
- Non-native, invasive vegetation removal.
- Propagation, planting, and establishment of native species that are characteristic of native limestone forest habitats (e.g., *A. mariannensis, G. mariannae, F. prolixa, M. citrifolia, W. elliptica*).

The degradation and loss of primary limestone and other forest habitats resulting from ungulate damage and invasion by alien plant species has substantially diminished the extent of habitat for native species in the Mariana archipelago. The anticipated benefit of implementing these mitigation

measures is improved habitat quality for native flora and fauna, including special-status species. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Terrestrial Conservation Areas. All cantonment and housing components would be constructed on the upper plateau area of Finegayan and South Finegayan. Construction personnel are issued base passes for official business only within proposed construction areas; these restrictions are specified in construction contracts. Use of Haputo ERA is not expected to increase as a result of construction activities under Alternative B; therefore, there would be no impact associated with construction personnel. The Haputo ERA would not be directly impacted and would continue to serve as a migration corridor for species moving or dispersing from AAFB and Finegayan to suitable habitat further south or from these areas to the north.

The only terrestrial conservation area within the impacted areas of Alternative B is Overlay Refuge. Overlay Refuge lands were established for the purpose of conserving and protecting ESA-listed species and other native flora and fauna, maintaining native ecosystems, and the conserving native biological diversity, recognizing that the primary purpose of lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force.

Approximately 947 acres (383 ha) of Overlay Refuge lands (Table 4.2.8-2), or 4.4% of the total Overlay Refuge lands on Guam, would be directly impacted under Alternative B. This is 296 acres (120 ha) less Overlay Refuge lands that would be impacted under Alternative B compared to Alternative A. This area overlaps with the vegetation communities discussed above. The majority of the impacted Overlay Refuge lands are associated with the cantonment component within Finegayan and is comprised primarily of secondary limestone forest (Table 4.2.8-2 and Figure 4.1.8-3). Therefore, because proposed construction activities would convert 947 acres (383 ha) of Overlay Refuge lands to developed areas, 175 acres (71 ha) of which is currently developed, this would be a significant loss to the conservation function of these lands and implementation of Alternative B would result in significant but mitigable impacts to terrestrial conservation areas.

Table 4.2.8-2. Direct Construction-Related Impacts to Overlay Refuge at Finegayan, South Finegayan, and Support Areas with Implementation of Cantonment/Family Housing Alternative B

Project Component	*Overlay Refuge (acres [ha])*						
	PLF	***SLF***	***HS***	***TT***	***CP***	***Dev***	***Total***
Finegayan cantonment	0.5 (0.2)	617.0 (249.7)	108.7 (44.0)	1.0 (0.4)	0	159.9 (64.7)	**887.1 (359.0)**
South Finegayan housing	0	0	0	0	0	0	**0**
Utility corridor specific to Alternative B	0	8.1 (3.3)	0	0	0	6.8 (2.8)	**14.9 (6.0)**
Utility corridors and water well areas common to Alternatives A-E	0	36.4 (14.7)	0	0	0	8.3 (3.4)	**44.7 (18.1)**
Total Overlay Refuge Impacted	**0.5 (0.2)**	**661.5 (267.7)**	**108.7 (44.0)**	**1.0 (0.4)**	**0**	**175.0 (70.8)**	**946.7 (383.1)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; TT = tangantangan; CF = *Casuarina* forest; CP = coconut plantation; Dev = developed.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on terrestrial conservation areas with implementation of Alternative B. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

The same BMPs discussed previously under *Vegetation* would be implemented for terrestrial conservation areas.

Potential Mitigation Measures

To mitigate for significant impacts to terrestrial conservation areas, the DON would submit a proposal to CNO Energy and Environmental Readiness Division to designate an ERA on the NAVMAG to conserve native limestone forest in southern Guam which provides habitat for special-status species. The DON has defined an ERA as a physical area or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural, physical, and biological processes to prevail without human intervention. However, under unusual circumstances, deliberate manipulation (e.g., removal or control of invasive species) may be utilized to maintain the unique feature that the ERA was established to protect (NAVFAC 1996). The proposed NAVMAG ERA would encompass approximately 553 acres (234 ha). Although the proposed NAVMAG ERA is currently part of the Overlay Refuge, implementation of these potential mitigation measures would provide an increased level of protection by further ensuring this area is maintained in natural and near natural conditions and to have available such areas for research and scientific manipulation (NAVFAC 1996; NAVFAC Marianas 2010).

In addition, the DON proposes to submit a proposal to CNO Energy and Environmental Readiness Division to expand the existing Orote ERA by approximately 32 acres (13 ha) of terrestrial habitat. The Final Orote ERA Expansion proposal was completed in FY 2013 and will be submitted for approval in 2014.

Wildlife - Native Species. No additional impacts to native wildlife species from construction beyond those described for Alternative A would occur under Alternative B. Therefore, there would be less than significant impacts to native wildlife species with implementation of proposed construction activities associated with Alternative B.

The following BMPs would be implemented to avoid and minimize potential direct, long-term impacts of proposed construction activities on native wildlife with implementation of Alternative B.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

With implementation of these BMPs, including development of HACCP plans and ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species (e.g., coconut rhinoceros beetle), the potential for the introduction of new or spread of existing non-native species on Guam is substantially reduced. Therefore, there would be less than significant impacts to native wildlife species related to the potential introduction and establishment of

non-native species with implementation of proposed construction activities associated with Alternative B.

Damage of forested areas, particularly primary and secondary limestone forests, by non-native ungulates (i.e., deer and pigs) is a serious concern on Guam. Under Alternative B, removal of large amounts of secondary limestone forest currently used by ungulates would displace and concentrate ungulates into adjacent areas, resulting in even higher densities and potentially greater habitat damage. Potential impacts from changes in ungulate densities from construction projects within the same or similar habitat areas as proposed in this SEIS were addressed in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-115).

The implementation of the potential mitigation measures under the *Vegetation* section above would also benefit native wildlife species. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

Special-Status Species: Federal ESA-Listed and Proposed Species

No additional impacts to federally listed and proposed species from construction beyond those described for Alternative A would occur under Alternative B.

MARIANA FRUIT BAT. Approximately 754 acres (305 ha) of Mariana fruit bat recovery habitat would be removed due to proposed construction activities at Finegayan, South Finegayan, and support areas on AAFB under Alternative B (Table 4.2.8-3). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. Under Alternative B, 203 acres (85 ha) less fruit bat recovery habitat would be removed than under Alternative A. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.2.8-3. Summary of Permanent Construction-Related Impacts to Mariana Fruit Bat Recovery Habitat with Implementation of Cantonment/Family Housing Alternative B

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment	635.0 (257.0)
South Finegayan housing	65.0 (26.3)
Utility corridor specific to Alternative B	8.1 (3.3)
Utility corridors and water well areas common to Alternatives A-E	46.2 (18.7)
Total Recovery Habitat Impacted	**754.3 (305.3)**

Additional potential direct temporary impacts to the Mariana fruit bat from construction activities are based on the distances from those activities that are likely to cause disturbance to this species (e.g., noise, human activity, lighting). The evaluation of fruit bat disturbance is based on the approach used by USFWS in previous ESA section 7 formal consultations and associated BOs (e.g., USFWS 2006b, 2010a). These distances are: roosting habitat within 492 feet (150 m) and foraging habitat within 328 feet (100 m) from the activity (Wiles, personal communication 2006 and Janeke, personal communication 2006, respectively, as cited in USFWS 2006b).

There are no historical fruit bat roost sites at Finegayan and there have been only two observations of fruit bats on or adjacent to Finegayan since the 1990s (Wiles *et al.* 1995; Brooke 2008). However, there is recovery habitat within the Alternative B impacted areas as well as the Haputo ERA immediately adjacent to Finegayan. As fruit bats are known to occur on AAFB to the north and have been observed within and adjacent to Finegayan (i.e., the HMU), it is highly likely that fruit bats use Haputo ERA for foraging and possibly roosting.

The species is currently limited to the few areas on Guam away from human activities and with suitable habitat, primarily on federal lands on the NAVMAG and AAFB (JRM *et al.* 2012a, 2012b; JRM 2013; A. Brooke, NAVFAC Marianas, personal communication). However, illegal hunting, loss and degradation of native forest, predation by the brown treesnake, and the increased extirpation risk owing to the high vulnerability of very small populations continue to limit the potential recovery of the species on Guam (USFWS 2010a; JRM 2013). Based on the equilibrium/carrying capacity of snakes on Guam (Rodda and Savidge 2007), implementation of the proposed action is not expected to increase the likelihood of predation by the brown treesnake on Mariana fruit bats.

Proposed construction activities would result in the loss of 791 acres (320 ha) of fruit bat recovery habitat on Guam (Table 4.2.8-3). Although this loss of recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, it would reduce the total number of bats that the island can support. Given this loss of recovery habitat and the critically low numbers of bats on Guam, there would be significant but mitigable impacts to the Mariana fruit bat.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on Mariana fruit bats with implementation of Alternative B. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Pre-Construction Surveys*. Surveys would be completed within suitable fruit bat habitat 1 week prior to onset of construction activities following the USFWS-approved JRM protocol. If a fruit bat is present within 492 feet (150 m) of the project site, the work must be postponed until the bat has left the area.
- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all new roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

Potential Mitigation Measures

The same potential mitigation measures discussed previously under *Vegetation* (i.e., forest enhancement of 815 acres [330 ha] of limestone forest) would be applicable for the Mariana fruit bat and its recovery habitat. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana fruit bat. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

MARIANA CROW. The Mariana crow is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the crow is reasonably certain to occur and it is

likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the crow, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative B, impacts to the crow would be limited to recovery prospects. If crows are reintroduced and exposed to construction activities under Alternative B, they may be disturbed (DON 2014).

Although the crow no longer occurs on Guam, approximately 754 acres (305 ha) of crow recovery habitat would be removed due to proposed construction activities at Finegayan, South Finegayan, and the AAFB support areas under Alternative B (Table 4.2.8-4). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. Under Alternative B, 203 acres (82 ha) less crow recovery habitat would be removed than under Alternative A. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.2.8-4. Summary of Permanent Construction-Related Impacts to Mariana Crow Recovery Habitat with Implementation of Cantonment/Family Housing Alternative B

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment	635.0 (257.0)
South Finegayan housing	65.0 (26.3)
Utility corridor specific to Alternative B	8.1 (3.3)
Utility corridors and water well areas common to Alternatives A-E	46.2 (18.7)
Total Recovery Habitat Impacted	**754.3 (305.3)**

Although this loss of recovery habitat on Guam would not preclude the recovery of the crow should it be reintroduced to Guam in the future, it would reduce the total number of crows that the island can support. If and when the crow is reintroduced to Guam, the best available information indicates project-related noise would not further reduce the amount of recovery habitat suitable for this species' breeding, feeding and sheltering (USFWS 2010a). Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Mariana crow.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of the Mariana crow with implementation of Alternative B. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

- *Brown Treesnake Research and Suppression*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.

- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 815 acres [330 ha] of limestone forest) would be applicable for the Mariana crow and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana crow, should it be reintroduced to Guam in the future.

GUAM RAIL. The Guam rail is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the rail is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the rail, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the rail is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative B, impacts to the rail would be limited to recovery prospects. If rails are reintroduced and exposed to construction activities under Alternative B, they may be disturbed (DON 2014).

Although the rail no longer occurs on Guam, approximately 571 acres (231 ha) of rail recovery habitat would be removed due to proposed construction activities at Finegayan, South Finegayan, and the AAFB support areas under Alternative B (Table 4.2.8-5). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. Under Alternative B, 71 acres (29 ha) more rail recovery habitat would be removed than under Alternative A. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.2.8-5. Summary of Permanent Construction-Related Impacts to Guam Rail Recovery Habitat with Implementation of Cantonment/Family Housing Alternative B

Project Component	***Recovery Habitat (acres [ha])***
Finegayan cantonment	388.0 (157.0)
South Finegayan housing	128.2 (51.9)
Utility corridor specific to Alternative B	18.6 (7.5)
Utility corridors and water well areas common to Alternatives A-E	35.8 (14.5)
Total Recovery Habitat Impacted	**570.6 (230.9)**

Although this loss of recovery habitat on Guam would not preclude the recovery of the rail should it be reintroduced to Guam in the future, it would reduce the total number of rails that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam rail.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the recovery of the Guam rail with implementation of Alternative B. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.

- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See the previous discussion of Mariana crow mitigation measures for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 815 acres [330 ha] of limestone forest) would be applicable for the Guam rail and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam rail, should it be reintroduced to Guam in the future.

GUAM MICRONESIAN KINGFISHER. The kingfisher is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the kingfisher is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the kingfisher, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the kingfisher is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative B, impacts to the kingfisher would be limited to recovery prospects. If kingfishers are reintroduced and exposed to construction activities under Alternative B, they may be disturbed (DON 2014).

Although the kingfisher no longer occurs on Guam, approximately 754 acres (305 ha) of kingfisher recovery habitat would be removed due to proposed construction activities at Finegayan, South Finegayan, and the AAFB support areas under Alternative B (Table 4.2.8-6). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. Under Alternative B, 203 acres (82 ha) less kingfisher recovery habitat would be removed than under Alternative A. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.2.8-6. Summary of Permanent Construction-Related Impacts to Guam Micronesian Kingfisher Recovery Habitat with Implementation of Cantonment/Family Housing Alternative B

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment	635.0 (257.0)
South Finegayan housing	65.0 (26.3)
Utility corridor specific to Alternative B	8.1 (3.3)
Utility corridors and water well areas common to Alternatives A-E	46.2 (18.7)
Total Recovery Habitat Impacted	**754.3 (305.3)**

Although this loss of recovery habitat on Guam would not preclude the recovery of the kingfisher should it be reintroduced to Guam in the future, it would reduce the total number of kingfishers that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam Micronesian kingfisher.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the recovery of the Guam Micronesian kingfisher with implementation of Alternative B. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See the previous discussion of Mariana crow mitigation measures for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 815 acres [330 ha] of limestone forest) would be applicable for the kingfisher and its recovery habitat. In particular, the objectives of ungulate management, rodent control, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam Micronesian kingfisher, should it be reintroduced to Guam in the future.

SEA TURTLES. The green and hawksbill sea turtles potentially nest along the Haputo ERA beach. All cantonment and housing components would be constructed on the upper plateau area of Finegayan and would not occur in the Haputo ERA or adjacent to the beach. Construction personnel are issued base passes for official business only within proposed construction areas; these restrictions are specified in construction contracts. Use of Haputo ERA is not expected to increase as a result of construction activities; therefore, there would be no impacts from construction personnel to sea turtles that may occur on the Haputo ERA beach.

To avoid and minimize any potential impacts to nesting sea turtles from proposed facility lighting associated with the construction of the cantonment/family housing area at Finegayan, hooded lights would be used to the maximum extent practicable at all new roads and facilities near coastline areas. Illumination of coastline areas would be kept to an absolute minimum. The implementation of the potential mitigation measures described above under *Vegetation* (i.e., forest enhancement of 815 acres [330 ha] of limestone forest) would also benefit the survival of sea turtles. In particular, the objectives of ungulate management, control/suppression of invasive plants, outplanting of native species, and rodent

control. Therefore, there would be no impacts to potential nesting sea turtles within the Haputo ERA with implementation of the proposed construction activities associated with Alternative B.

TREE SNAILS. The three proposed endangered species of tree snails only occur within the Haputo ERA. All cantonment and housing components would be constructed on the upper plateau area of Finegayan and would not occur in the Haputo ERA. Construction personnel are issued base passes for official business only within proposed construction areas; these restrictions are specified in construction contracts. Use of Haputo ERA is not expected to increase as a result of construction activities; therefore, there would be no impacts from construction personnel to tree snails that occur within the Haputo ERA. Therefore, there would be no impacts to tree snails occurring within the Haputo ERA with implementation of the proposed construction activities associated with Alternative B.

The implementation of the potential forest enhancement mitigation measures described above for the Mariana crow would also benefit the survival of tree snails. In particular, the objectives of ungulate management, rodent control, control/suppression of invasive plants, and outplanting of native species.

MARIANA EIGHT-SPOT BUTTERFLY. The two known host plant species for the eight-spot butterfly have not been reported within the proposed project area and there are no records of the species within the AAFB support areas. However, given the proximity of the eight-spot butterfly area to Finegayan (see Figure 4.1.8-4) and the high mobility of the species, the species is likely to occur within the larger Finegayan area.

Some species of tropical butterflies have well-developed ears on their wings and can detect sounds at the same frequencies that humans can hear. It is hypothesized that the butterflies are listening to the flight sounds or foraging calls of predatory birds (Lane *et al.* 2008; Yack 2012). Given the low numbers of forest birds currently on Guam due to the brown treesnake, masking of the flight sounds or foraging calls of predatory birds due to noise from proposed construction activities would not make eight-spot butterflies more susceptible to predation.

With implementation of appropriate BMPs to avoid and minimize potential impacts to eight-spot butterflies (e.g., pre-construction butterfly and host plant surveys within the proposed construction footprint and salvage/relocation of host plants, larvae or eggs), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed construction activities associated with Alternative B. In addition, implementation of the potential mitigation measures described above under *Vegetation* (i.e., forest enhancement of 815 acres [330 ha] of limestone forest) would also benefit the survival the eight-spot butterfly. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species, including eight-spot butterfly host plants.

SERIANTHES TREE. Although individual *Serianthes* trees do not occur within the impacted areas of Alternative B, approximately 619 acres (250 ha) of *Serianthes* recovery habitat would be removed due to proposed construction activities at Finegayan, South Finegayan, and the AAFB support areas under Alternative B (Table 4.2.8-7). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. This is 15 acres (6 ha) less *Serianthes* recovery habitat that would be removed under Alternative A. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.2.8-7. Summary of Permanent Construction-Related Impacts to *Serianthes* Recovery Habitat with Implementation of Cantonment/Family Housing Alternative B

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment	573.8 (232.2)
South Finegayan housing	0
Utility corridor specific to Alternative B	6.1 (2.5)
Utility corridors and water well areas common to Alternatives A-E	38.6 (15.6)
Total Recovery Habitat Impacted	**618.5 (250.3)**

Although this loss of recovery habitat would not preclude the recovery of *Serianthes* on Guam, given the loss of 619 acres (250 ha) of *Serianthes* recovery habitat, there would be significant but mitigable impacts to the recovery of *Serianthes* on Guam.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of *Serianthes* with implementation of Alternative B. Final mitigation measures would be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, Vegetation for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 815 acres [330 ha] of limestone forest) would be applicable for *Serianthes* recovery habitat. In particular, the objectives of ungulate management, rodent control, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for *Serianthes*. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Special-Status Species: Guam-Listed and SOGCN

MICRONESIAN STARLING. As this species is rarely recorded from Finegayan, South Finegayan, and in the impacted area on AAFB associated with the support areas of Alternative B, there would be no impacts to the starling with implementation of proposed construction activities under Alternative B.

WHITE-THROATED GROUND DOVE. Although considered extirpated from Guam since the 1980s, the white-throated ground dove has been observed on AAFB on rare occasions (JRM *et al.* 2012a, 2012b; NAVFAC Marianas 2013b). The primary cause of its extirpation and lack of reestablishment on Guam is due to predation by the brown treesnake (GDAWR 2006). It has not been reported in the proposed impacted areas associated with Alternative B, only in other areas on AAFB including the MSA and the

southeastern corner of AAFB. Therefore, there would be no impacts to the white-throated ground dove with implementation of the construction activities associated with Alternative B.

MOTH SKINK AND PACIFIC SLENDER-TOED GECKO. The moth skink and Pacific slender-toed gecko are were detected in northeastern corner of Finegayan and within a proposed utility corridor along the south-central area of AAFB within secondary limestone forest that would be directly impacted under Alternative B (see Figures 4.1.8-4 and 4.1.8-5). Construction activities associated with Alternative B would result in the loss of approximately 815 acres (330 ha) of occupied limestone forest habitat for both the skink and gecko; this would be less than the 1,007 acres (408 ha) impacted under Alternative A. The loss of approximately 815 acres (330 ha) of occupied limestone forest habitat for both the skink and gecko would be a significant but mitigable impact.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct long-term impacts of proposed construction activities on the moth skink and slender-toed gecko with implementation of Alternative B. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, Vegetation for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

The potential forest enhancement mitigation measures described above in the *Vegetation* section would also result in a conservation benefit to the moth skink and slender-toed gecko. The proposed brown treesnake research and suppression measures discussed above under the Mariana crow may also benefit the skink and gecko. See the potential mitigation discussions for the Mariana crow, Micronesian kingfisher, and the Guam rail for more information.

No additional impacts to other Guam-listed species and SOGCN from construction beyond those previously described for Alternative A (see Section 4.1.8.2) would occur under Alternative B. Therefore, there would be less than significant impacts to Guam-listed species and SOGCN with implementation of proposed construction activities associated with Alternative B.

Operation

Operational impacts would only occur for the proposed cantonment and housing at Finegayan/South Finegayan. Operational requirements for the proposed utilities would require only periodic, limited maintenance activities along established utility corridors and impacts to biological resources would be less than significant. Consequently, only the potential operational impacts at the proposed Finegayan/South Finegayan cantonment and housing area are evaluated below.

Vegetation. No additional impacts to vegetation from operations beyond those previously described for Alternative A (see Section 4.1.8.2) would occur under Alternative B. With implementation of BMPs and potential mitigation measures (see previous discussion of construction impacts under *Vegetation*),

including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, 1-year post construction monitoring to evaluate effectiveness of HACCP, and applicable elements of the SIP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the proposed cantonment/family housing under Alternative B is considered unlikely. Therefore, there would be less than significant impacts to vegetation with operation of the proposed cantonment/family housing at Finegayan/South Finegayan under Alternative B.

Terrestrial Conservation Areas. No additional impacts to terrestrial conservation areas from operations beyond those previously described for Alternative A (see Section 4.1.8.2) would occur under Alternative B. After construction of the cantonment and housing areas under Alternative B, the majority of remaining designated Overlay Refuge area on Finegayan would be developed. Therefore, operational activities of the cantonment and housing areas under Alternative B are expected to result in less than significant impacts to the remaining Overlay Refuge lands on Finegayan.

All cantonment and housing components would be located on the upper plateau area of Finegayan/South Finegayan and not within the Haputo ERA. However, potential increased usage of the Haputo ERA by military and civilian personnel associated with the proposed cantonment and housing facilities at Finegayan/South Finegayan would result in significant but mitigable impacts to the Haputo ERA. The following potential mitigation measures may be implemented to mitigate potential direct, long-term impacts of proposed operational activities on the Haputo ERA with implementation of Alternative B.

Potential Mitigation Measures

The following measures may be implemented to mitigate potential direct, long-term impacts of proposed operational activities on the Haputo ERA with implementation of Alternative B.

- Fencing of the Haputo ERA access trail to control and manage access.
- Development and installation of informational and educational signage.
- Development of educational materials for military and civilian personnel on the sensitive biological resources within the Haputo ERA.
- Monitoring of visitor use.

An ERA is established to conserve and protect characteristic or outstanding botanical, ecological, geological, and scenic features or processes and where current natural conditions are maintained. These conditions are ordinarily achieved by allowing natural, physical, and biological processes to prevail without human intervention. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent overuse and potential damage to terrestrial biological resources. These measures are consistent with the goals and objectives of the Haputo ERA Management Plan (NAVFAC Marianas 2010).

Wildlife - Native Species. Potential impacts to wildlife were evaluated in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-101) for a similar proposed action but impacting a larger area, and were found to be less than significant. No additional impacts to native wildlife from operations beyond those previously described for Alternative A (see Section 4.1.8.2) would occur under Alternative B.

No additional impacts to native wildlife species from operations beyond those previously described for Alternative A (see Section 4.1.8.2) would occur under Alternative B. With implementation of BMPs and

potential mitigation measures (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, 1-year post construction monitoring to evaluate effectiveness of HACCP, and applicable elements of the SIP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the proposed cantonment/family housing under Alternative B is considered unlikely. The DON recognizes the USFWS' ongoing concern regarding potential spread of the brown treesnake. The DON will consult with USFWS under ESA section 7 to determine if additional brown treesnake interdiction measures are warranted and applicable. Therefore, there would be less than significant impacts to native wildlife with operation of the proposed cantonment/family housing at Finegayan/South Finegayan under Alternative B.

However, the following BMPs would be implemented to avoid and minimize potential indirect, long-term impacts of proposed operational activities on native wildlife with implementation of Alternative B.

Best Management Practices

- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.
- *Prevention of Free-Roaming Cats and Dogs*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of DON policies regarding free-roaming cats and dogs.

With implementation of these BMPs, including ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the risk of the introduction and establishment of new or spread of existing non-native species on Guam is substantially reduced.

Continued implementation of the potential mitigation measures under the Construction, *Vegetation* and *Special-status Species* sections above would also benefit native wildlife species and habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species. The implementation of the potential mitigation measures under the *Terrestrial Conservation Areas* section above would also benefit native wildlife species. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to native wildlife species within the Haputo ERA. Therefore, there would be less than significant impacts to native wildlife species related to the introduction and establishment of non-native species due to operational activities associated with Alternative B.

Special-Status Species: Federal ESA-Listed and Proposed Species

No additional impacts to federally listed and proposed species from operations beyond those described for Alternative A would occur under Alternative B.

MARIANA FRUIT BAT. Potential impacts to the Mariana fruit bat from operational activities are based on the distances from operations that are likely to cause disturbance to this species (e.g., noise, lighting, and general human disturbance). These are the same distances that were previously discussed for construction impacts. This area of fruit bat recovery habitat would continue to be impacted from operational activities of the cantonment and housing area at Finegayan/South Finegayan after construction activities have ceased.

There are no historical fruit bat roost sites at Finegayan and there have been only two observations of fruit bats on or adjacent to Finegayan since the 1990s (Wiles *et al.* 1995; Brooke 2008). However, there is fruit bat recovery habitat within the Alternative B impacted areas as well as the Haputo ERA immediately adjacent to Finegayan. As fruit bats are known to occur on AAFB to the north and have been observed within and adjacent to Finegayan (i.e., the HMU), it is highly likely that fruit bats use the primary limestone forest within the Haputo ERA for foraging and possibly roosting.

Operation of the proposed cantonment and housing areas under Alternative B would result in significant but mitigable impacts to fruit bats due to potential direct disturbance (e.g., noise, lighting, and general human disturbance) to fruit bats within 150-m of the cantonment/family housing area. The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential long-term impacts of proposed operational activities on the Mariana fruit bat with implementation of Alternative B.

Best Management Practices

- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.
- With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, 1-year post construction monitoring to evaluate effectiveness of HACCP, and applicable elements of the SIP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the proposed cantonment/family housing under Alternative B is considered unlikely.

Potential Mitigation Measures

- Continued implementation of the potential mitigation measures under the Construction, *Vegetation* and *Special-status Species* sections above would also benefit the Mariana fruit bat and recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species. The implementation of the potential mitigation measures under the *Terrestrial Conservation Areas* section above would also benefit the fruit bat and recovery habitat. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to fruit bats within the Haputo ERA.

MARIANA CROW, GUAM RAIL, AND GUAM MICRONESIAN KINGFISHER. These species are extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of these species is reasonably certain to occur and the species are likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of these species, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow, rail, and kingfisher are successfully re-introduced and then have the potential to be exposed to cantonment and housing operational activities under Alternative B, there would be no impact to these species. If the species are

reintroduced and exposed to cantonment and housing operational activities under Alternative B, they may be disturbed.

SEA TURTLES. Potential impacts to sea turtles were evaluated for a similar, but larger proposed action in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, NCTS and South Finegayan; page 10-118), and were found to be less than significant and would continue to be less than significant with implementation of this alternative. Two suspected nest attempts by green sea turtles have been observed at Haputo Beach between 2008 and 2010, with no observations of nest attempts during 51 surveys from 2010 to 2012 (Grimm and Farley 2008; NAVFAC Marianas 2011; Brindock 2012).

As discussed previously under construction impacts, to avoid and minimize any potential impacts to nesting and potential hatchling sea turtles from proposed facility lighting at Finegayan/South Finegayan, hooded lights would be used to the maximum extent practicable at all new roads and facilities near coastline areas. Illumination of coastline areas would be kept to an absolute minimum.

The implementation of the potential mitigation measures under the Construction, *Vegetation* and *Terrestrial Conservation Areas* sections above would benefit the survival of sea turtles (e.g., reducing erosion, reducing nest predation by rodents). In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Pets are not permitted in the Haputo ERA. This policy would prevent potential impacts to nesting sea turtles from harassment, injury or mortality from pets. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to nesting sea turtles that may potentially use Haputo Beach.

Given the low probability of sea turtle nesting at Haputo Beach combined with implementation of potential mitigation measures for *Vegetation*, *Terrestrial Conservation Areas* and *Wildlife-Native Species*, impacts resulting from the proposed action would be less than significant to nesting sea turtles at Haputo Beach within the Haputo ERA with implementation of the operational activities associated with Alternative B.

MARIANA EIGHT-SPOT BUTTERFLY. Mariana eight-spot butterflies and its host plants are known to occur within the Haputo ERA, but not within the impacted areas of Finegayan (see Figure 4.1.8-4). With the exception of periodic fence maintenance in the northern portion of Haputo ERA near the known butterfly area, there would be no operational impacts to butterflies or host plants with implementation of Alternative B.

TREE SNAILS. Three species of proposed endangered tree snails, are present along the coast in the Haputo ERA. Potential impacts to tree snails at Haputo ERA were evaluated for a similar, but larger proposed action in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-118). Potential impacts to tree snails at the Haputo ERA due to operations associated with Alternative B would be less than significant. Implementation of the potential mitigation measures discussed below would provide additional benefits to tree snails.

The implementation of the potential mitigation measures under the *Vegetation* and *Terrestrial Conservation Areas* sections above would also benefit tree snails. In particular, the objectives of ungulate management, rodent control, control/suppression of invasive plants, and outplanting of native species proposed under the potential forest enhancement mitigation measures. There is the potential for impacts to tree snails within the Haputo ERA from disturbance of vegetation and collecting and handling of tree snails due to increased usage of the ERA by military and civilian personnel associated with the proposed

cantonment and housing facilities at Finegayan/South Finegayan. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to tree snail species and their habitat within the Haputo ERA.

There would be no impacts to *Tabernaemontana rotensis* and *Cycas micronesica* due to operations associated with Alternative B. The implementation of the potential mitigation measures under the *Terrestrial Conservation Areas* section above would also benefit *C. micronesica*. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to this species within the Haputo ERA.

Special-Status Species: Guam-Listed and SOGCN

No additional impacts to Guam-listed species and SOGCN from operations beyond those described for Alternative A would occur under Alternative B. There would be no impacts to the moth skink or slender-toed gecko due to operations associated with Alternative B. The implementation of the potential mitigation measures under the *Terrestrial Conservation Areas* section above would also benefit the skink and gecko. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to these species and their habitat within the Haputo ERA.

4.2.9 Marine Biological Resources

4.2.9.1 Affected Environment

The affected environment for marine biological resources in the vicinity of Alternative B would be similar to that previously discussed for Alternative A, described in Section 4.1.9.1. The main difference is that the proposed South Finegayan housing area would be located farther inland from that coast and away from marine biological resources (Figure 4.2.9-1).

4.2.9.2 Environmental Consequences

The environmental consequences for marine biological resources associated with Alternative B would be similar to those previously described for Alternative A in Section 4.1.9.2. Because housing would be developed in South Finegayan, which is located farther from the coast (including Haputo Beach) compared to housing proposed for Alternative A, the potential for any impact to marine biological resources would be further minimized. The only anticipated indirect impact to all marine biological resources is associated with increased wastewater flows from the Northern District WWTP. These impacts and the associated mitigation would be the same for Alternative B as described for Alternative A in Section 4.1.9.2. In addition, less than significant indirect impacts (short-term and long-term) to marine biological resources from recreational use may occur as described for Alternative A.

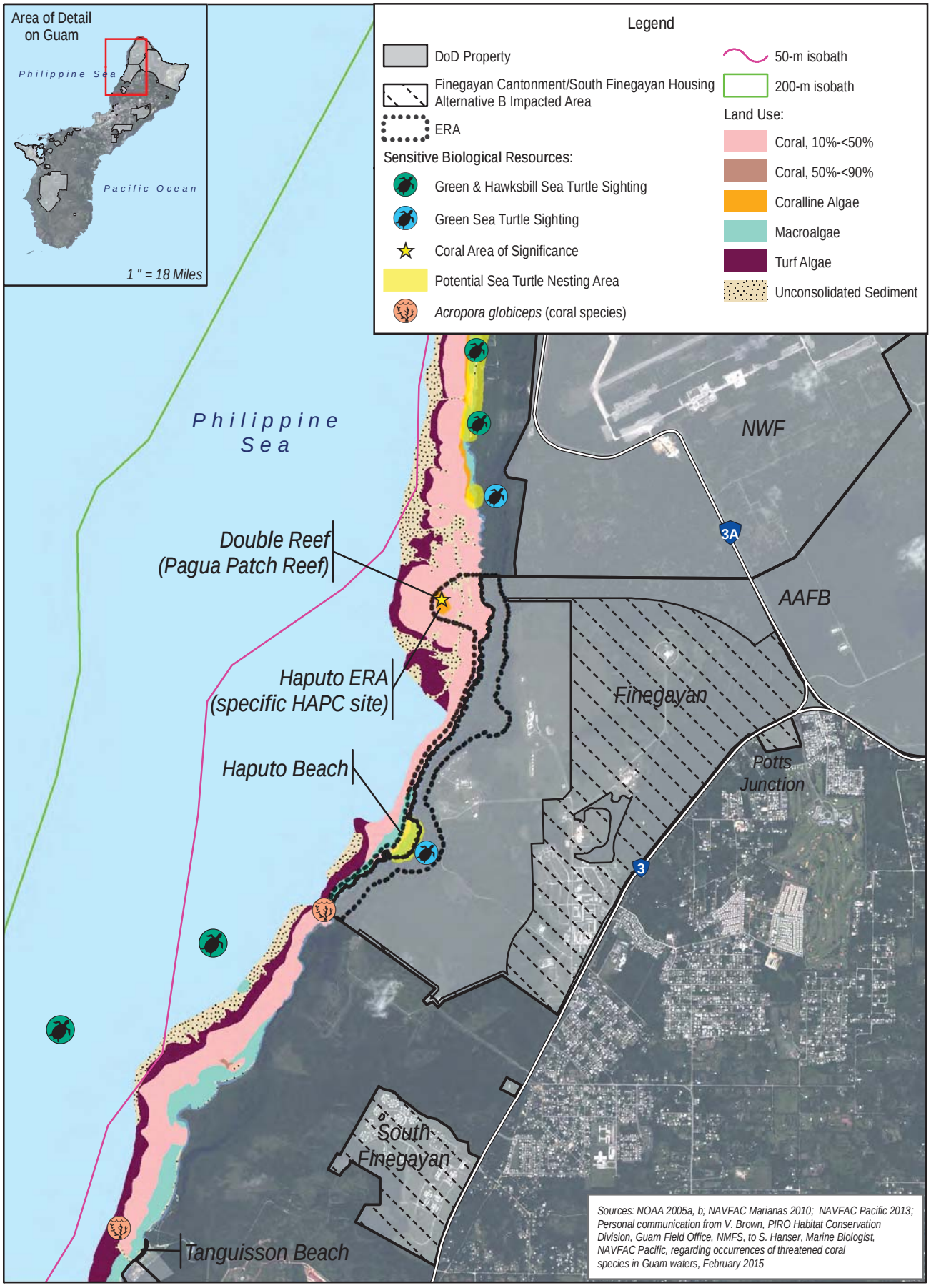


Figure 4.2.9-1
Overview of Sensitive Marine Biological Resources and Nearshore Habitat – Finegayan Cantonment/South Finegayan Housing Alternative B

4.2.10 Cultural Resources

4.2.10.1 Affected Environment

The following discussion summarizes previous cultural resources studies and known historic properties and other cultural resources within the area of potential cultural resource impacts associated with Alternative B. The discussion below addresses historic properties, as defined in the NHPA, and resources of cultural importance as defined under NEPA. The discussion refers to the terms *direct effects* and *indirect effects* to historic properties as defined under the NHPA, and impacts to other cultural resources as defined under NEPA (see Section 3.10.3.2). The section is organized to address cultural resources for the cantonment/family housing, followed by discussion of the same resource types for off-site utilities and school expansions associated with this alternative. If this alternative is selected for implementation, the information presented here would be augmented by reviews consistent with the 2011 PA, which provides overall NHPA Section 106 compliance and addresses other cultural resource issues. Refer to Section 3.10 for a detailed description of the 2011 PA. Additionally, some built properties in this section are covered by *Program Comments* executed by the ACHP, which resolve Section 106 responsibilities for certain DoD facilities. See Chapter 3, Section 3.10 for more information on definitions and procedures.

As discussed under Alternative A (Section 4.1.10.1), Finegayan is a telecommunications installation. South Finegayan has contained military family housing since the early 1970s. BEQs were first constructed there in 1956. The Finegayan cantonment and South Finegayan housing alternative (Alternative B) would construct and operate administrative and housing areas, community support facilities (e.g., schools, child development center, community center), and associated utilities (see Figure 2.4-6 in Chapter 2 of this SEIS).

The affected environment for cultural resources associated with Alternative B is generally consistent with the affected environment description for Alternative A for Finegayan and with the information in the 2010 Final EIS for South Finegayan (Volume 2, Chapter 12: Cultural Resources, Section 12.1.2.2: Finegayan, page 12-20), which were based on surveys of PDIAs completed at that time. While no in-fill surveys for cultural resources were conducted for Alternative B in support of this SEIS, the description of the affected environment provided here has been updated with new information from recent archaeological and architectural investigations supporting other projects.

Surveys conducted to support the 2010 Final EIS included the PDIA for Alternative B. Those previous investigations included intensive archaeological surveys (Athens 2009; Welch 2010), architectural inventories (Welch 2010), potential TCP studies (Griffin *et al.* 2010), and oral histories (Welch 2010). Portions of South Finegayan were surveyed in an intensive archaeological survey conducted by Olmo *et al.* (2000 as cited in Tomonari-Tuggle *et al.* 2007) and by Athens in 2008 (Athens 2009). The Latte Stone Park site discovered in the 1970s (Birkedal and McCarty 1972) was listed in the NRHP as a result. Other reconnaissance level cultural resource surveys were conducted in disturbed areas of South Finegayan, mainly around the Latte Stone Park site (Birkedal and McCarty1972; Craib 1994; Craib and Yoklavich 1996). This area has been highly disturbed by bulldozing and clearing activities for the current buildings. The previous investigations provide a comprehensive inventory of cultural resources occurring within the Alternative B PDIA.

In addition to the primary cantonment and housing areas, on-site utility corridors associated with Alternative B would be located along the eastern boundary of Finegayan and continue south along the eastern edge of South Finegayan, and in the southern portion of AAFB (see Figure 2.4-7). A reconnaissance level survey was conducted for the proposed utilities adjacent to Route 3 east of Finegayan in 2010 and no archaeological sites were recorded (Dixon *et al.* 2011b). Intensive

archaeological surveys of the utility line PDIA on AAFB along Route 9 were conducted in 2004 (Yee *et al.* 2004), 2008 (Athens 2009), and 2010 (Dixon and Walker 2011).

All cantonment alternatives would include construction of off-site utilities along Routes 1, 3, and 9, a water well field at AAFB, and expansion or construction of two schools at Naval Base Guam and AAFB (see Figure 2.4-14). Assessments of potential impacts to cultural resources from construction of utilities along road right-of-ways are based on a reconnaissance survey of portions of the area in 2010 (Dixon *et al.* 2011b) and a literature review of previous surveys and historic development in the area. Assessments of impacts to cultural resources from the development of a water well field and from the two school expansions are based on in-fill surveys conducted in support of this SEIS (Dixon *et al.* 2014).

Based on data from previous surveys of the proposed cantonment/family housing area, and utility corridors, Table 4.2.10-1 lists the 20 known archaeological sites located within the PDIA for Alternative B on Finegayan. Eight sites are eligible for listing in the NRHP and one site (Latte Stone Park, GHPI Number 66-08-0141) is listed in the NRHP. Griffin and others also identified Latte Stone Park as a potential TCP (Griffin *et al.* 2010). It is described as a Pre-Contact/Latte Period habitation site. The remaining 11 sites are not eligible for listing in the NRHP.

Table 4.2.10-1. Archaeological Sites within the Finegayan Cantonment/South Finegayan Housing Alternative PDIA

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-0141	811	Latte Stone Park	Pre-Contact/Latte	Birkedal and McCarty 1972	Listed	A, D
66-08-1350***	1029	Water catchment structure	First American Territorial	Welch 2010	Yes	D
66-08-2293	NF1	Concrete foundations, concrete-curbed pit, artifact scatters	Post-WWII/Second American Territorial	Athens 2009	No	NA
66-08-2294	NF2	Concrete pads and slabs	Post-WWII/Second American Territorial	Athens 2009	No	NA
66-08-2295	1012	Artifact scatter	Pre-Contact/Latte	Athens 2009	No	NA
66-08-2296	1018	Artifact scatter	Pre-Contact/Latte	Athens 2009	No	NA
66-08-2297	1019	Artifact scatter	Pre-Contact/Latte	Athens 2009	No	NA
66-08-2298	1020	Artifact scatter	Pre-Contact/Latte	Athens 2009	No	NA
66-08-2302***	ANT-2/1025	Encampment	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-08-2303***	ANT-3/1026	Habitation site/artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2304***	ANT-5/1027	Encampment	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-08-2305	ANT-6/1028	Encampment	Post-WWII/Second American Territorial	Welch 2010	Yes	D
66-08-2306***	ANT-8/1030	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2307***	ANT-9/1033	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2308***	ANT-10/1034	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2309***	ANT-11/1035	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2316	1059	Displaced artifacts (bulldozed berms)	WWII Japanese Military Occupation	Welch 2010	No	NA

Table 4.2.10-1. Archaeological Sites within the Finegayan Cantonment/South Finegayan Housing Alternative PDIA

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-2317	1060	Structural remains (foundations and other debris)	Post-WWII/Second American Territorial	Welch 2010	No	NA
	T-H-1	Concrete foundations/artifact scatter	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2701	T-1/378	Ceramic scatter	Pre-Contact/Latte	Haun 1988	Yes	D

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable. NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

*Map numbers are from Welch *et al.* (2009) and Welch (2010).

**Revised to match Guam GHPI forms dated May 28, 2014.

***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2, 2014 [RC2013-0853]).

Two NRHP-eligible archaeological sites, located on AAFB, have been identified within the PDIA for Alternative B on-site utility corridors (see Figure 2.4-7; see Table 4.1.10-2 under Alternative A). However, data recovery for both sites has been performed as mitigation for a previous project (Eakin *et al.* 2012).

There are 426 architectural properties, constructed between 1954 and 2001, within the PDIA for Alternative B (Table 4.2.10-2). These buildings and structures include barracks, administrative facilities, and recreational facilities. A total of 273 buildings located at South Finegayan are covered under the *Program Comment for Wherry and Capehart Era Family Housing at Air Force and Navy Bases* (ACHP 2004; see Chapter 3.10.3 for more information on the Program Comments). Fifty-four buildings are housing covered under the *Program Comment for Cold War Era Unaccompanied Personnel Housing* (ACHP 2006). Ten buildings or structures are support facilities (recreational and hydrologic facilities) that are greater than 50 years in age or undated that have not been evaluated. If Alternative B were selected, any unevaluated properties would be evaluated under the procedures identified in the 2011 PA. Eighty-nine buildings have been determined ineligible for listing in the NRHP, including 26 buildings that are less than 50 years old and do not meet the exceptional significance threshold required under NRHP Criteria Consideration G. The 2011 PA includes procedures for the identification of historic properties, as specific projects are developed, through consultation with the Guam SHPO and the public.

Table 4.2.10-2. Summary of Architectural Properties Located within the Finegayan Cantonment/South Finegayan Housing Alternative PDIA

Building/Structure Type	*Location*	*Number of Buildings/Structures of this Type in Potential Impacted Area*	*Date of Construction*	*NRHP Eligible?*
Housing Facilities for Unaccompanied Personnel (barracks)	Finegayan	37	1954 to 1968	Covered under Program Comment
Ancillary Housing Facilities (garages)	Finegayan	13	1954 to 1966	Covered under Program Comment
Housing Support Facilities	Finegayan	4	1954 to 1955	Covered under Program Comment
Housing Facilities	South Finegayan	124	1972 to 1974	Covered under Program Comment
Ancillary Housing Facilities (carports)	South Finegayan	108	1972 to 1974	Covered under Program Comment
Enlisted Men's Quarters	South Finegayan	41	1972	Covered under Program Comment
Support Facilities				
Recreational Facilities	Finegayan	1	1963	Not Evaluated
Hydrologic Support Facilities	Finegayan	2	1954 to 1965	Not Evaluated
Wells	Finegayan	5	Unknown	Not Evaluated
Pavilions/Bus Stop Shelters	Finegayan	33	1961 (n=1); Unknown (n=32)	No
Unknown	Finegayan	2	1968 (n=1) Unknown (n=1)	Not Evaluated
Administrative, utilities, recreation, training, and support facilities	Finegayan	26	1953 to 1965	No
Administrative, utilities, recreation, and support facilities	Finegayan	24	1966 to 1994	No
Bus Stops	South Finegayan	3	Unknown	No
Recreation and other support facilities	South Finegayan	3	1979 to 2001	No

Note: Information on type, number, and date of construction from iNFADS.

In addition to the cantonment/family housing, and utility corridor areas, Alternative B would include construction of off-site utilities, a water well field, and expansion or construction of two schools. Cultural resources are the same as those discussed under Alternative A. These include the presence of 9 known NRHP-eligible archaeological sites and 15 sites not considered eligible for listing in the NRHP (see Alternative A, Table 4.1.10-4). As under Alternative A, 1 structure within the well development area on AAFB is eligible for listing in the NRHP, 4 structures are not eligible, and 6 structures are unevaluated. In addition, three structures on AAFB not eligible for listing in the NRHP (see Table 4.1.10-5) are located in the proposed Andersen Middle School expansion. No archaeological sites or TCPs have been recorded in the Andersen Middle School or DoDEA High School PDIA.

4.2.10.2 Environmental Consequences

Construction

Construction activities associated with Alternative B may adversely affect historic properties. Final determinations of effect will occur under the 2011 PA. Following is a discussion of potential adverse effects for purposes of this analysis. Excavation and soil removal associated with buildings and utilities construction could adversely affect 11 known NRHP-eligible or listed archaeological sites (see Table 4.2.10-1 and Table 4.1.10-2 under Alternative A). However, two of these sites (GHPI Number 66-08-2551 and 66-08-2552) have been previously mitigated (Eakin *et al.* 2012). Latte Stone Park (GHPI Number 66-08-0141) would be avoided; therefore, no direct effects would occur to Latte Stone Park.

Construction activities at Alternative B would also require the demolition of 24 buildings at Finegayan and 48 buildings at South Finegayan (Table 4.2.10-3). Of these 72 buildings in the PDIA, 64 are covered under either the *Program Comment for Wherry and Capehart Era Family Housing at Air Force and Navy Bases* (ACHP 2004) or the *Program Comment for Cold War Era Unaccompanied Personnel Housing* (ACHP 2006), 7 are not eligible, and 1 (facility number 209) is unevaluated. The Program Comment resolves NHPA Section 106 requirements for demolition of the 64 buildings. As the seven buildings are not eligible for listing in the NRHP, their demolition under Alternative B would be consistent with a finding of no historic properties affected. Consistent with the 2011 PA, final determinations of eligibility, including the one unevaluated property, and assessment of effect would be completed in conjunction with project-specific reviews, if this alternative is selected.

Table 4.2.10-3. Architectural Properties to be Demolished within the Finegayan Cantonment/South Finegayan Housing Alternative PDIA

Building Name or Type	*Location*	*Facility Number(s)*	*Date of Construction*	*NRHP Eligible?*
Andersen Softball Field	Finegayan	159	1965	No
Public Quarters Junior Officer	Finegayan	173, 175, 185, 187, 188, 189, 191, 192, 193, 194, C190	1955	Covered under Program Comment
Public Quarters Enlisted	Finegayan	C202, C203, C204, C205	1963	Covered under Program Comment
Public Quarters - CO	Finegayan	197	1966	Covered under Program Comment
CDAA Building/Standby Generator 350 KW	Finegayan	200	1964	No
CDAA Building/Standby Generator 350 KW	Finegayan	204	1972	No
Swimming Pool/Bathhouse	Finegayan	209	1963	Not Evaluated
NEX Storage Warehouse	Finegayan	305	1973	No
CDAA Chill Water Plant	Finegayan	335	1978	No
Bus Stop Shelter	Finegayan	387	Unknown	No
Swimming Pool Pavilion	Finegayan	498	1987	No
Enlisted Men's Quarters	South Finegayan	717-740	1972	Covered under Program Comment
Officers' Quarters	South Finegayan	1225, 1226, 1227, 1228, 1229, 1230, 1231, 1232, 1233, 1234, 1235, 1236, 1237, 1238, 1239, 1240	1972	Covered under Program Comment
Company Grade Officers' Quarters	South Finegayan	1253, 1254, 1255, 1260, 1261, 1262, 1263, 1264	1974	Covered under Program Comment

Two actions under Alternative B are similar to Alternative A, off-site utility construction and the expansion of Andersen Middle School and the DoDEA High School. Excavation and soil removal associated with the construction of off-site utilities and expansion of two schools could adversely affect 9 known NRHP-eligible archaeological sites (see Alternative A, Tables 4.1.10-4 and 4.1.10-5) and 1 NRHP-eligible structure. Six structures that are unevaluated could also be affected by construction.

The Andersen Middle School expansion would require the demolition of three structures, which are not eligible for listing in the NRHP (see Alternative A, Table 4.1.10-6).

In addition, construction at Finegayan has the potential to directly impact culturally important resources that are not historic properties, but may be considered under NEPA. The project would require the removal of limestone forest where culturally important natural resources may be present. The 2011 PA contains measures for coordinating with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans regarding identification and disposition of these important resources (see 2010 Final EIS, Volume 2: page 2-10; Volume 9, Appendix G, Chapter 4).

Operation

Operations associated with the Alternative B would not directly affect any historic properties or impact other resources of cultural importance. Indirect adverse effects to known NRHP-eligible archaeological sites on the coast could occur due to an increase in personnel in the area. The potential for indirect adverse effects to the Haputo site (GHPI Number 66-08-0007) and Latte Stone Park could increase due to an anticipated general increase in use of recreational resources (see Sections 4.1.7 and 4.2.7). The 2011 PA has a provision for Cultural Resources Awareness Training and the placement of informational signage to reduce the risk of damage.

Summary of Impacts and Potential Mitigation Measures

Implementation of Alternative B could cause direct, adverse effects to 17 known NRHP-eligible or listed sites and 1 structure, which is fewer than Alternative A, but more than Alternatives C and D. Refer to Section 4.7, Table 4.7-1 for a comparison of cultural resources impacts and potential mitigation measures for each cantonment/family housing alternative. These are the same sites that could be adversely affected under Alternative A. Two additional NRHP-eligible sites have been previously mitigated. There could be indirect adverse effects to two archaeological sites/potential TCPs at Haputo and Latte Stone Park due to an increase in visitors and an increased potential for inadvertent or accidental damage. Demolition could also affect 10 buildings that have not been evaluated for listing in the NRHP (see Tables 4.1.10-5 and 4.2.10-3).

Direct impacts could occur to natural resources of cultural importance as a result of limestone forest removal. The 2011 PA includes measures to coordinate with the SHPO and concurring parties to address appropriate treatment of these resources.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. Broadly, the 2011 PA includes processes to share information, consider views of the public, and develop mitigation measures when historic properties may be adversely affected. The 2011 PA provides measures for mitigating adverse effects to NRHP-eligible or listed archaeological sites, consulting on new projects and initiating additional identification efforts, and resolving impacts due to loss of access to areas of cultural importance or culturally important natural resources. To the degree possible, impacts to historic properties and resources of cultural importance would be avoided or minimized during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not

possible, Table 4.2.10-4 presents potential mitigation measures to resolve adverse effects to historic properties and reduce impacts to cultural resources from the implementation of Alternative B. With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that significant direct and indirect impacts due to construction and operations, as defined under NEPA, would be reduced to a level below significance.

Table 4.2.10-4. Potential Mitigation Measures for Alternative B for Adverse Effects (NHPA) and Impacts to Other Cultural Resources (NEPA)

NHPA Effects	***Mitigation***
Potential direct adverse effects to 18 historic properties—17 NRHP-eligible archaeological sites and 1 NRHP-eligible structure	Consistent with the 2011 PA, data recovery is the standard mitigation for historic properties that are strictly archaeological in nature. Accordingly, the DON will submit a mitigation plan to the SHPO, consult with other PA Signatories and Concurring Parties if requested, and submit data recovery reports for SHPO review prior to finalizing mitigation reports. Mitigation also includes preparation of public education and interpretation materials in English and Chamorro using the information developed or data recovered to create a summary of the work completed and a statement regarding the mitigated site's significance to the regional culture. Additional mitigation could include enforcement of construction contract stipulations and GHPI data form updates as required by the 2011 PA.
Potential indirect adverse effects to two NRHP-eligible archaeological sites/potential TCPs	The DON will conduct initial orientation briefs for incoming DoD personnel to enhance Cultural Resources Awareness and strategically place educational signage to reduce the risk of inadvertent damage.
Undetermined effects to 7 unevaluated buildings	If this alternative is selected in the ROD, unevaluated properties that may be affected would be evaluated consistent with the 2011 PA. If determined eligible for listing in the NRHP, appropriate mitigation measures would be developed to resolve any adverse effects.
NEPA Impacts	***Mitigation***
Potential direct impacts to culturally important natural resources	Through the 2011 PA process, coordinate with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans to provide an opportunity to collect these resources consistent with installation security instructions and safety guidelines.

4.2.11 Visual Resources

4.2.11.1 Affected Environment

A list and description of visual resources at Finegayan and South Finegayan are contained in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.1.1.2: Affected Environment, pages 13-9 to 13-15). The South Finegayan site lies approximately 1 mile (1.6 km) south of Finegayan. It consists of an existing DON housing area on the eastern side of the parcel and natural appearing vegetation to the west along the coastal cliffline. Except for the communications facilities, South Finegayan has a similar landscape to Finegayan, but includes extensive grasslands previously developed for DoD use. From an aerial view, the scenic effect between Finegayan and South Finegayan is similar, but the ground-level view is slightly different due to the shorter vegetation that dominates the plant community at South Finegayan. Because of this, views from Route 3 into South Finegayan are relatively open and are similar to those into central Finegayan. Views from the ocean are similar to those of Finegayan (i.e., they are primarily of heavily vegetated limestone cliffs that tend to obscure the existing man-made development).

4.2.11.2 Environmental Consequences

Construction

Existing public views would be temporarily impeded by the presence of construction equipment, but would be restored after construction. Therefore, there would be minimal, less than significant direct short-term impacts on visual resources.

Operation

Long-term impacts from operations would be less than significant on visual resources. The impacts would be somewhat less than those impacts assessed in the 2010 Final EIS, as there is less development proposed under this alternative. For discussion on identified impacts, see 2010 Final EIS, Volume 2, Chapter 13: Visual Resources, Section 13.2.2: Environmental Consequences, pages 13-65 to 13-67. None of the recognized viewpoints, vistas, or overlooks on non-federal lands would be expected to be impacted by the various developments being proposed, beyond those anticipated impacts analyzed and discussed in the 2010 Final EIS.

The new base features would be designed to be consistent with the 2011 Installation Insurance Plan. While the base would not be accessible to the public, some features would be publicly visible, including the entrance gates, perimeter fencing, peripheral landscaping, and vertical infrastructure (i.e., light posts and water tanks). The previously mentioned features and the remaining new base features would present a united design template as outlined in the Installation Insurance Plan. Consequently, less than significant direct, long-term impacts on visual resources would result from implementation of this alternative.

4.2.12 Ground Transportation

4.2.12.1 Affected Environment

Transportation associated with Alternative B includes transportation facilities internal to the site (on-base roadways and intersections), and entry control facilities. This section discusses existing conditions and assesses how the construction and operations of Alternative B would potentially affect transportation conditions for roadways, transit facilities, and pedestrian and bicycle facilities on-base. Potential ground transportation impacts to off-base (external) roadways are addressed in Section 6.1 of this SEIS.

Roadway Network

The cantonment portion of Alternative B is located at Finegayan and is the same as Alternative A. The family housing area of Alternative B is located at South Finegayan. Finegayan is currently accessible via the existing gate located on Route 3 near Bullard Avenue. South Finegayan is currently accessible via the existing gate located on Route 3 at Royal Palm Drive. Currently, all of the on-base roadways are two lanes (one lane in each direction). Traffic counts at these military access points were conducted in December 2012. Based on the relatively low traffic demand observed at these locations, the internal roadways and intersections are expected to operate at acceptable LOS (LOS A, B, C, D, or E) during the weekday a.m. and weekday p.m. peak hours.

Transit Network

There is no existing transit service on Finegayan or South Finegayan. The GRTA operates fixed route and paratransit service. The Blueline 1, servicing Hagåtña, Tamuning, Micronesia Mall, and Tumon, is the nearest fixed route bus line, and operates at a distance of approximately 5.6 miles (9.0 km) from Finegayan/South Finegayan. Paratransit service is provided to all ADA-eligible certified passengers, by providing transportation to the nearest fixed route.

Pedestrian and Bicycle Network

There are no dedicated pedestrian or bicycle facilities on or near Finegayan or South Finegayan. However, shoulders exist along Route 1 and on Route 3, south of Route 28. Typically, the outside lane or shoulder, which is generally unpaved, functions as the pedestrian/bicycle space.

4.2.12.2 Environmental Consequences

Potential ground transportation impacts addressed in this section are limited to elements of the proposed action that could affect on-base (internal) roadways. Potential ground transportation impacts to off-base (external) roadways are addressed in Section 6.1 of this SEIS.

Construction

Potential construction impacts generated by the proposed action at Alternative B would be similar to Alternative A (Section 4.1.12.2). Potential short-term impacts to ground transportation resources from construction would be reduced to less than significant levels with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, construction of Alternative B would have less than significant impacts to on-base (internal) roadways.

Operation

Roadway Network

As currently proposed, Alternative B would be composed of two separate, non-contiguous development areas. The Finegayan cantonment area would be directly accessible from Route 3 and Route 3A. The South Finegayan family housing area would be directly accessible from Route 3. The cantonment area would be located at the north end of the site and would be accessible via a new Main Gate. The new Main Gate would be aligned with the westbound approach of the second roadway south of Potts Junction (i.e., the roadway immediately south of the access road to the Starts Golf Resort). Also, at the north end of the site, a new Commercial/Tactical Vehicle Gate would be constructed on Route 3A. The family housing area would be located approximately 1.5 miles (2.4 km) south of the cantonment area and would be accessible via a new Residential Gate. To reach the cantonment area, a vehicle originating from the family housing area would exit South Finegayan via the proposed new Residential Gate, travel northbound on Route 3, and enter the cantonment via the proposed new Main Gate.

The proposed on-base (internal) roadway network hierarchy for Alternative B was determined based on the conceptual development plan and layout of the cantonment/family housing area, and takes into account the capacity required to accommodate the expected travel demand on the facilities. The proposed on-base (internal) roadway network hierarchy diagram for Alternative B is included in Appendix F of this SEIS. The proposed roadway hierarchy for the cantonment at Finegayan under Alternative B is the same as Alternative A (Section 4.1.12.2). Under Alternative B, a collector roadway would run from the proposed new Residential Gate to the central boulevard within the family housing area at South Finegayan. This roadway would carry all of the traffic to/from the family housing area.

Under any of the proposed cantonment/family housing alternatives, construction of new on-base (internal) roadway facilities and entry control facilities would be required. The proposed action includes construction of on-base (internal) roadways and entry control facilities that would be implemented by DoD. On-base (internal) roadways and entry control facilities for Alternative B, include, but are not limited to, the following:

- The existing main gate would be closed and a new Main Gate would be constructed. The new Main Gate would form the fourth leg (westbound approach) of the existing Route 3/Chalan Kareta intersection.
- A new Commercial/Tactical Vehicle Gate would be constructed at the north end of the main cantonment, on Route 3A.
- The existing main gate to the South Finegayan site would be closed. A new Residential Gate would be constructed just south of the existing gate, and would replace it. The new gate would form a three-legged intersection with Route 3.

All on-base (internal) roadway segments and intersections have been designed with the capacity required to accommodate the expected travel demand. Specifically, on-base (internal) roadway segments and intersections are designed to operate at acceptable LOS (LOS A, B, C, D, or E) under future year (Year 2030) conditions with the proposed action.

The proposed action would not result in direct, long-term significant impacts to on-base (internal) roadways or intersections, because the proposed action would not:

- For roadway segments and intersections - cause a roadway segment or intersection operating at acceptable LOS (LOS A, B, C, D, or E) to degrade to unacceptable LOS F.
- For roadway segments - add 5% or more to the total directional peak hour volume for roadway segments (measured in passenger car equivalents) and result in unacceptable LOS F.
- For intersections - add 50 or more peak hour trips (measured in passenger car equivalents) and result in unacceptable LOS F at intersections.

Under Alternative B, the family housing area at South Finegayan would not be internally connected with the cantonment area at Finegayan. Travel between the two areas would require the use of off-base (external) roadways, specifically, Route 3. Potential impacts to off-base (external) roadway segments and intersection are summarized in Section 6.1 of this SEIS.

Entry Control Facilities

The operations of the proposed ECFs are controlled, or dictated, by the traffic demand and the vehicle processing speed at the security check point. The methodology and assumptions utilized to evaluate operations and potential for queuing at the entry control facilities are stated in Section 4.1.12.1.

Transit Conditions

The proposed action would not result in a direct or indirect long-term significant impact to transit, because the proposed action would not:

- Substantially increase traffic hazards to transit due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with applicable design standards.
- Fundamentally conflict with adopted policies, plans, or programs regarding public transit; or otherwise decrease the performance or safety of transit facilities.

Pedestrian and Bicycle Conditions

Bicycle and pedestrian facilities would be included in the construction of new on-base (internal) roadway facilities. Bicycle and pedestrian paths and facilities are integrated into the on-base transportation network as a means to improve mobility and safety of non-motorized traffic. The proposed bicycle and pedestrian network diagram for Alternative B is provided in an Appendix to this SEIS.

Under Alternative B, the proposed pedestrian and bicycle network for the cantonment area at Finegayan is the same as that proposed under Alternative A. The proposed pedestrian and bicycle network at South Finegayan family housing area includes sidewalks on both sides of all residential streets. Additionally, a jogging/biking trail would be provided around the periphery.

The proposed action would not result in a direct or indirect long-term significant impact to pedestrians or bicycles, because the proposed action would not:

- Substantially increase traffic hazards to pedestrians or bicycles due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with applicable design standards.
- Fundamentally conflict with adopted policies, plans, or programs regarding bicycle or pedestrian facilities; or otherwise, decrease the performance or safety of such facilities.

4.2.13 Marine Transportation

4.2.13.1 Affected Environment

The affected environment for marine transportation associated with Alternative B is the same as described in Section 4.1.13.1 for Alternative A.

4.2.13.2 Environmental Consequences

The environmental consequences for marine transportation associated with Alternative B would be the same as described for Alternative A.

4.2.14 Utilities

4.2.14.1 Affected Environment

This section includes information related to existing electrical, potable water, wastewater, solid waste, and IT/COMM utilities as they apply to Alternative B.

Electrical Power

Alternative B areas have the same affected environment as Alternative A, but with the housing area shifted to South Finegayan. South Finegayan is provided power from the GPA and has basic residential type distribution systems. There is no power generation capability at South Finegayan. The power being supplied to this area comes from the GPA generation system via a DoD-owned 34.5 kV transmission power lines. This line is currently leased to the GPA by the DON. The situation and condition of these utility systems is unchanged from the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1: Affected Environment, page 3-5).

Potable Water

Alternative B areas have the same affected environment as Alternative A, but with some additional water system components at South Finegayan. The additional components at South Finegayan include a 250,000-gallon (946,353-liter) elevated tank that is planned for demolition and replacement as mentioned in the Alternative A affected environment section. There are two production wells at South Finegayan that are not actively producing water due to high chloride levels. If these wells are abandoned, water for South Finegayan would come from the DoD water system connection along Route 3.

Wastewater

The GWA compliance background presented for Alternative B is the same as for Alternative A.

Alternative B areas have the same affected environment as Alternative A, but with some additional wastewater system components at South Finegayan. The South Finegayan Housing area's wastewater system is primarily a gravity system bisected by a 30-inch (76-cm) interceptor sewer managed by the GWA. The existing sewers in South Finegayan area connect at various points to the GWA 30-inch (75-cm) interceptor. Both Finegayan and South Finegayan sewers feed into the Northern District WWTP.

Solid Waste

The affected solid waste infrastructure for Alternative B is the same as for Alternative A.

Information Technology and Communications

The affected IT/COMM infrastructure for Alternative B is the same as for Alternative A.

4.2.14.2 Environmental Consequences

The assessment of impacts associated with utilities assumed the implementation of sustainability strategies as described in Section 8.6, Sustainability and Smart Growth. These strategies include measures to achieve federally mandated levels of energy use reduction, water use reduction, waste reduction, and total energy from renewable sources.

Electrical Power

Based on the load projections for both the cantonment and family housing, no upgrade would be required to the GPA's generating capacity, since the total load increase is within the current capacity of their generating plants. However, upgrades to existing 34.5 kV transmission power lines would be required to stay within operating parameters. This electrical power distribution system for Alternative B, as described in Section 2.4.4.2, has been developed to handle the increased long-term demand from the proposed action. The proposed electrical power distribution system for Alternative B is basically the same as for Alternative A, as described in Section 4.1.14.2, but with the addition of an underground distribution cable from Finegayan to South Finegayan along Route 3 to provide power to the South Finegayan family housing area. See Alternative A, Section 4.1.14.2 for electrical power environmental consequences at Finegayan/South Finegayan, including the island-wide impacts.

The short- and long-term direct impacts to the power system are deemed less than significant, both during construction and in operation.

Potable Water

The proposed water infrastructure for Alternative B, as described in Section 2.4.4.2, has been developed to meet the needs of the proposed action. The environmental consequences for potable water for Alternative B are the same as for Alternative A, as discussed in Section 4.1.14.2.

The short- and long-term direct impacts to the DoD and the GWA water systems are deemed less than significant, both during construction and in operation.

NGLA Water Extraction

Potential short- and long-term impacts to the NGLA, and potential mitigation measures for impacts would be the same for Alternative B as for Alternative A, as described in Section 4.1.14.2. Thus, the localized direct impact to the NGLA is considered significant, but the impact to the overall NGLA is less than significant. Mitigation measures for Alternative B are the same as for Alternative A in Section 4.1.14.2.

Wastewater

The proposed wastewater infrastructure for Alternative B, as described in Section 2.4.4.2, has been developed to meet the needs of the proposed action. The environmental consequences and mitigation measures for wastewater under Alternative B would be the same as under Alternative A. However, there would be potential for a sewage spill in the rerouting of the existing GWA interceptor sewer at South Finegayan feeding the Northern District WWTP, as compared to Alternative A. This potential could be mitigated to a less than significant impact by careful planning during construction.

Solid Waste

The solid waste infrastructure for Alternative B, has been developed to meet the requirements of the proposed action. The environmental consequences for the solid waste utility associated with the population buildup for Alternative B would be almost the same as for Alternative A described in Section 4.1.14.2 under solid waste. The only difference would be the small increase of additional South Finegayan waste pickup truck traffic on Route 3 transporting the solid waste from the family housing area to the transfer facility at Finegayan cantonment.

The direct and indirect, short- and long-term impacts on solid waste from Alternative B would be less than significant during construction and operation.

Information Technology and Communications

The IT/COMM infrastructure for Alternative B as described in Chapter 2 of this SEIS has been developed to meet the requirements of the proposed action. The environmental consequences for IT/COMM for Alternative B would be the same as for Alternative A.

The short- and long-term direct impacts on IT/COMM from Alternative B would be less than significant during construction and in operation.

4.2.15 Socioeconomics and General Services

4.2.15.1 Affected Environment

The affected environment for Socioeconomics and General Services on Guam is presented for the entire island of Guam and does not vary by alternative. Because the affected environment does not vary by alternative, it is only presented one time, under Alternative A. A full description of the affected environment for Socioeconomics and General Services is presented in Section 4.1.15.

4.2.15.2 Environmental Consequences

The Socioeconomics and General Services impacts under Alternative B would be island-wide and would be the same as described under Alternative A in Section 4.1.15.

Impacts related to population change would be mixed with some adverse and some beneficial outcomes. Population increases would bring about increased demand on Guam's public services agencies, but also increased economic activity and GovGuam tax revenues. Impacts would be direct and indirect, and short- and long-term. Overall economic impacts would be beneficial, and Guam's housing stock and availability would be able to absorb increased demand for housing. There is a potential for sociocultural impacts to occur, but the magnitude of the impacts could vary substantially based on policy and program choices yet to be made on how to address them.

4.2.16 Hazardous Materials and Waste

4.2.16.1 Affected Environment

The current DoD ROI on Guam for hazardous materials and waste in this section includes the DON properties proposed for development of the cantonment and housing and the areas affected by off-site utilities development and DoD school expansions (see Section 2.4.4.6 in Chapter 2 of this SEIS). The DON properties include Finegayan, South Finegayan and Potts Junction.

The affected environment at Finegayan and Potts Junction prior to implementation of the proposed action is described in Section 4.1.16 of this SEIS. Therefore, this section focuses on the affected environment and environmental consequences of the proposed action at South Finegayan, the proposed site for Alternative B housing development.

Hazardous Materials Management

Hazardous materials at South Finegayan are managed as described for Finegayan in Section 4.1.16 of this SEIS.

Hazardous Waste Management

Hazardous wastes at South Finegayan are managed as described for Finegayan in Section 4.1.16 of this SEIS.

Contaminated Sites

Installation Restoration Program Sites

There is one active IRP site, IR Public Works Center Site 2810: Construction Battalion Landfill, located on South Finegayan that may be directly affected by the proposed development of housing under this alternative (Figure 4.2.16-1). This 2.6 acre (1 ha) site was primarily used for the disposal of maintenance shop waste. Land use controls have been implemented for the site and no further actions are planned. The site is currently subject to 5-year reviews.

Military Munitions Response Program Sites

No MMRP sites were identified in the area of South Finegayan proposed for development for family housing under Alternative B (Figure 4.2.16-1).

Toxic Substances

There are numerous structures located on South Finegayan that may be directly affected by the proposed development of the family housing under this alternative. Any structure constructed prior to 1978 may contain LBP, ACM, and PCBs. According to USEPA, the parcel is located in an area classified as Zone 1 for Radon indicating average indoor radon levels of greater than 4 pCi/L.

4.2.16.2 Environmental Consequences

Short-term construction impacts and long-term operational impacts to hazardous materials and waste under this alternative would be similar to those described under Section 4.1.16.2 of this SEIS. Therefore, implementation of Alternative B would result in less than significant direct and indirect impacts to hazardous materials and waste.

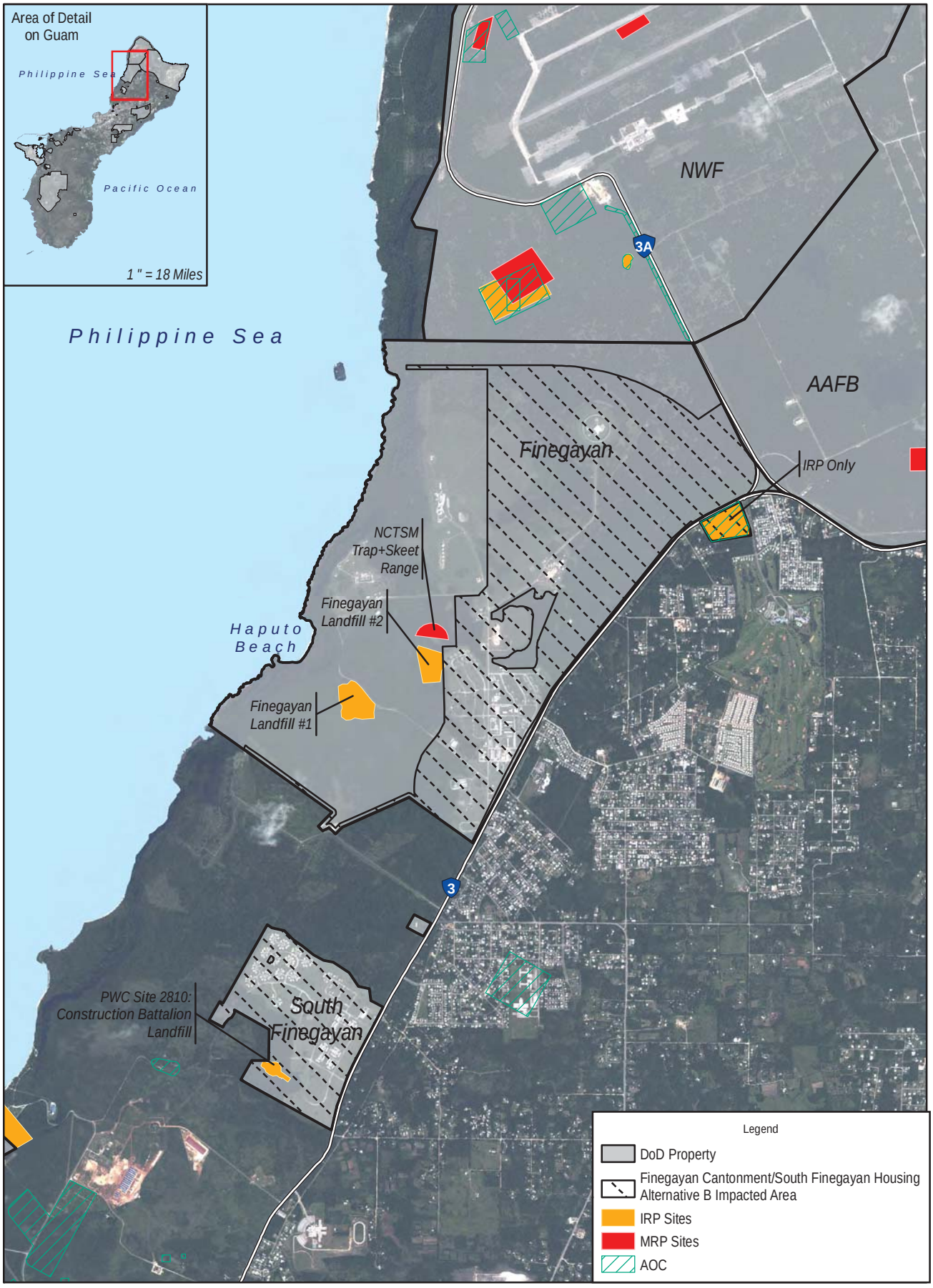


Figure 4.2.16-1
Active or Restricted IRP Sites, MMRP Sites, and AOC in the Vicinity of Finegayan Cantonment/South Finegayan Housing Alternative B

Source: NAVFAC Pacific 2013

4.2.17 Public Health and Safety

4.2.17.1 Affected Environment

Notifiable Diseases

The affected environment for notifiable diseases for Alternative B is the same as discussed in Section 4.1.17.1 for Alternative A.

Mental Illness

The affected environment for mental illness for Alternative B is the same as discussed in Section 4.1.17.1 for Alternative A.

Operational Safety

To protect the general public from intentional or accidental entry into the Finegayan cantonment and South Finegayan housing areas, locked or manned gates are used at vehicle access points and a series of signs warning unauthorized personnel not to enter the area are posted along the perimeter of the installations. Unauthorized personnel are not allowed on the installations at any time.

A small arms range is situated on the west-central portion of Finegayan. Activities at this range are conducted in accordance with SOPs to ensure the safety of both range participants as well as the public.

A portion of Finegayan is reserved for communication operations. These areas are essential for the current mission, which is to provide continuous global and universal communications services to fleet units, shore activities, other federal agencies, and joint forces. These reserved areas include EMR hazard safety zones for emitters to ensure the safety of workers and the public. South Finegayan contains housing units that are currently unoccupied.

Environmental Health Effects

Noise

There are no airfields or airfield operations located at Alternative B that generate noise. However, aircraft departing AAFB fly over these areas and generate noise in the range of 60-65 dB. Current noise levels are within the acceptable range for residential facilities. Details regarding current noise conditions at Finegayan and South Finegayan are provided in Section 4.2.4.1.

Water Quality

Several water wells are situated within the Finegayan boundary or are immediately adjacent to the installation. Several wells are also situated immediately adjacent to the South Finegayan housing area. These wells each have a mandated 1,000-foot (305-m) buffer identified as a wellhead protection zone. Within this zone, future activities and development are restricted to ensure contaminants are not introduced in these areas, thus protecting the integrity of the island's freshwater aquifers. Guam's freshwater aquifers are susceptible to contamination from surface activities. GEPA requires treatment to ensure water quality meets safe drinking water standards. Section 4.1.2.1 provides details regarding current quality of potable water sources.

Hazardous Substances

Current management practices and contingency plans for the use, handling, storage, transportation, and disposition of hazardous substances associated with Finegayan and South Finegayan ensure exposure to the environment and human contact are minimized.

The IRP focuses on cleaning up releases of hazardous substances that pose risks to the public and/or the environment. Two IRP sites are situated within Finegayan and one site is situated within South Finegayan. These sites include Finegayan Landfill #1, Finegayan Landfill #2 within Finegayan, and Construction Battalion Landfill within South Finegayan.

Landfill #1 contains buried metals, scrap wood, solvents, and other industrial waste, as well as municipal refuse. Landfill #2 contains building rubble and demolition debris, waste oils, solvents, insulation materials, PCB-containing oils, and oil filters. Water sampling detected concentrations of lead well below the federal maximum contaminant level for drinking water and determined that the lead concentrations detected may reflect background levels in the groundwater in northern Guam, and that no contaminants migrated from the landfills into groundwater. The Construction Battalion Landfill contains scrap metal, aircraft and vehicle parts, tires, concrete rubble, glass, paint cans, and small quantities of domestic trash and petroleum waste. Surface soils at this site present a potentially unacceptable risk to human health and the environment. However, the landfill has been capped and fenced to prevent contact with waste and contaminated soil. Site investigation fieldwork has been completed at the first two sites. No significant health hazards have been observed from sampling events, though the sites have not yet been closed. The final remedy for the Construction Battalion Landfill involves implementation of land use controls. The hazardous materials and waste section of this SEIS (see Section 4.2.16) provides additional detail for the status of IRP sites.

Unexploded Ordnance

Based on previous investigations at Finegayan and South Finegayan, UXO is known to be present (DON 2012).

Traffic Incidents

The nearest high crash frequency location in the vicinity of Finegayan and South Finegayan is the intersection of Route 1 and Route 3 (approximately 1.5 miles [2.4 km] south of South Finegayan and 3 miles [4.8 km] south of Finegayan). This intersection has been identified by GPD as having a high frequency of traffic incidents.

4.2.17.2 Environmental Consequences

Notifiable Diseases

Potential increases in notifiable diseases for Alternative B would be the same as discussed in Section 4.1.17.2 for Alternative A.

Mental Illness

Potential increases in mental illness for Alternative B would be the same as discussed in Section 4.1.17.2 for Alternative A.

Operational Safety

To protect the general public from intentional or accidental entry onto Finegayan and South Finegayan, locked or manned gates would continue to be used where vehicle access is provided and a series of signs

warning unauthorized personnel not to enter the areas would remain posted along the perimeter of the installations. Unauthorized personnel would not be allowed on the installations at any time.

The primary operational activities that would occur within the cantonment and housing area include:

- Administrative, supply, service, and maintenance functions for operational units.
- Base support functions.
- Unaccompanied personnel housing and related support functions (e.g., school, child development center, youth center).
- Training functions (i.e., classroom instruction and non-live fire training).
- Community support functions.

Specific and documented procedures would continue to be in place to ensure the public is not endangered by operations and training activities. Therefore, Alternative B would result in no direct or indirect impacts on public health and safety (resulting from operations and training activities).

Electromagnetic Safety

Use of Finegayan to support cantonment requirements for relocated Marines would be conducted so that new developments are consistent with established EMR hazard zones. Because electromagnetic emission sources would be operated in accordance with applicable safety standards and the public would be excluded from entering areas where emission sources are located, potential long-term impacts from electromagnetic emissions on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to electromagnetic emissions is anticipated.

Construction Safety

Because a health and safety program would be implemented for construction activities and the public would be excluded from entering construction areas, potential short-term construction impacts on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to construction activities is anticipated.

Environmental Health Effects

Noise

Potential short-term construction and long-term operational noise emissions associated with Alternative B would be similar to those discussed under Alternative A. Enforcement of OSHA guidelines for hearing protection for workers would be the responsibility of the construction contractor. The public would be excluded from entering construction areas. Therefore, short-term construction noise impacts on public health and safety would be less than significant. Long-term operational noise from activities occurring within the cantonment and housing areas would be similar to current noise levels. Therefore, overall direct or indirect impacts associated with noise to human health and safety would be less than significant.

Water Quality

Potential water quality impacts associated with Alternative B would be similar to those discussed under Alternative A. The annual groundwater withdrawal would be less than sustainable yield, and monitoring of groundwater chemistry would ensure no harm to the water supply. Future development and operational activities would be conducted in accordance with GEPA guidance and BMPs to minimize the potential for contaminants to be introduced. Therefore, direct and indirect public health and safety impacts from

long-term increased demand on potable water and potential water-related illnesses would be less than significant.

Hazardous Substances

Potential direct impacts from hazardous substances for Alternative B would be similar to those discussed under Alternative A. The use, handling, storage, transportation, and disposition of hazardous substances would be conducted in accordance with applicable hazardous material and waste regulations and established BMPs and SOPs to ensure that the health and safety of workers and the general public is maintained.

IRP investigations and/or remediation activities, as necessary, would continue in an effort to clean up past releases of hazardous substances that pose a risk to the public and the environment and receive regulatory concurrence that necessary actions have been completed to ensure the safety of the public. Based on investigations of the contaminants associated with sites on Finegayan and South Finegayan, no health hazards have been identified. Land use controls implemented at the Construction Battalion Landfill ensure that the capped waste is not disturbed, excavated, or removed unless done in accordance with special handling procedures and prior consent of the DON and GEPA. Based on the location of the IRP sites (which do not affect proposed cantonment and housing areas and no off-site population is nearby) and the continuation of investigative/cleanup activities in accordance with applicable regulations and established BMPs and SOPs, no health hazards have been identified. Therefore, no direct or indirect impacts on public health and safety are anticipated.

Unexploded Ordnance

Potential direct impacts from UXO would be similar to those discussed under Alternative A. With the exception of public access provisions outlined through the 2011 PA process (see Section 4.4.10, Cultural Resources), the general public would be excluded from entering construction zones and training areas. To reduce the potential hazards related to the exposure to MEC, ESS documentation would be prepared that outlines specific measures that would be implemented to ensure the safety of workers and the public. BMPs would be implemented to identify and remove potential MEC items prior to the initiation of ground-disturbing activities. UXO personnel supervision would occur during earth-moving activities and MEC awareness training would be provided to construction personnel involved in grading and excavations prior to and during ground-disturbing activities. In addition, the DON provides MEC awareness training to GovGuam and other public representatives allowing access to project sites to facilitate surveys or collection of natural resources or items of cultural significance prior to conducting vegetation clearance. Because UXO would be identified and removed prior to initiating construction activities and construction personnel would be trained as to the hazards associated with UXO, potential direct impacts from encounters with UXO would be minimized and less than significant.

Traffic Incidents

Potential long-term traffic incident increases for Alternative B would be similar to those discussed under Alternative A. The potential for long-term increased traffic incidents is small (5% increase [see Section 4.1.17.2]). Because the high crash frequency intersection is located distant to Finegayan/South Finegayan and the overall potential long-term increase in the number of traffic accidents as a result of the increase in personnel would be minimal, there would be a less than significant impact on the health and safety of the citizens of Guam (from traffic incidents).

4.2.18 Environmental Justice and the Protection of Children

4.2.18.1 Affected Environment

As described in Section 4.1.18, the affected environment for the environmental justice and the protection of children analysis is the entire island of Guam. Therefore, the affected environment under Alternative B is the same as for Alternative A. In addition, Alternative B is located in the northern area of the island, the same region as Alternative A. The villages of Dededo and Yigo are within this region.

4.2.18.2 Environmental Consequences

Potential impacts to environmental justice populations from Alternative B would be related to noise, recreation, socioeconomics and general services (including health services), and public health and safety.

Noise

The potential impacts would be the same as Alternative A.

Recreation

Impacts are generally island-wide and would be the same as described for Alternative A.

Socioeconomics and General Services

Impacts are generally island-wide and would be the same as described for Alternative A, as would the identified measures to mitigate impacts.

Public Health and Safety

Impacts are generally island-wide and would be the same as described for Alternative A, as would the identified measures to mitigate impacts.

4.3 ANDERSEN AIR FORCE BASE CANTONMENT/HOUSING - ALTERNATIVE C

Under Alternative C, the proposed development of a cantonment area and family housing would occur at AAFB. Details about this alternative are provided in Section 2.4.4.3 and the proposed site is illustrated in Figures 2.4-8 and 2.4-9.

4.3.1 Geological and Soil Resources

4.3.1.1 Affected Environment

The affected environment for geological and soil resources under Alternative C is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.1.2 North, pages 3-14 to 3-15), which is summarized below for reference. In addition, the geological and soils affected environment for projects common to all alternatives (i.e., school expansions and off-site utilities) would be similar or identical to those described for Alternative A. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for geological and soil resources, but it would reduce some potential impacts to geological and soil resources that were determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, which is described in the analysis of environmental consequences for Alternative C below.

AAFB is located on the northeastern portion of Guam's limestone plateau. Existing geologic and soil conditions at the proposed AAFB Alternative C footprint are similar to those described in Section 4.1.1.1 of this SEIS for Finegayan. Old (Barrigada) and young (Mariana) limestones comprise the bedrock (Figure 4.3.1-1). Similar to Finegayan, the porous limestone bedrock underlying AAFB is the geologic setting for sinkhole formation (see Section 3.1.1.1). Based on available topographic and field data, there are 28 features that have been preliminarily identified as sinkholes/depressions that may contain sinkholes in the Alternative C footprint.

Elevations along the northern edge of the limestone plateau range from 295 to 590 feet (90 to 180 m) above MSL (Figure 4.3.1-2). At the edge of the plateau, steep cliffs give way to a narrow coastal lowland terrace that surrounds the plateau on the north, east, and west. Within the northern portion of the proposed Alternative C footprint (proposed cantonment), there is a very gradual downward slope from the edge of the plateau toward the southwest. In the southern portion of the Alternative C footprint (proposed family housing) from a high point of approximately 530 feet (160 m) MSL in the southwest, land slopes gradually downward to the west, north, and east.

Approximately 40% of the soil in the Alternative C footprint is classified as Urban Land Complex, due to development for housing and recreational purposes. Guam Cobbly Clay Loam and Ritidian Rock Outcrop Complex soils cover the rest of the Alternative C footprint. Prime farmland soils, as defined by the USDA, are soils best suited to producing food, seed, forage, fiber and oilseed crops, are favorable for economic production and sustained high yield, and require minimal inputs of energy and result in the least damage to the environment (Young 1988). None of the soils in the proposed project area are identified as prime farmland by the USDA (Figure 4.3.1-2) (Young 1988). With respect to geologic hazards, conditions at Alternative C are similar to those described for Alternative A in Section 4.1.1.1. There are two mapped minor geologic faults in the western portion of the proposed Alternative C cantonment parcel (Figure 4.3.1-1).

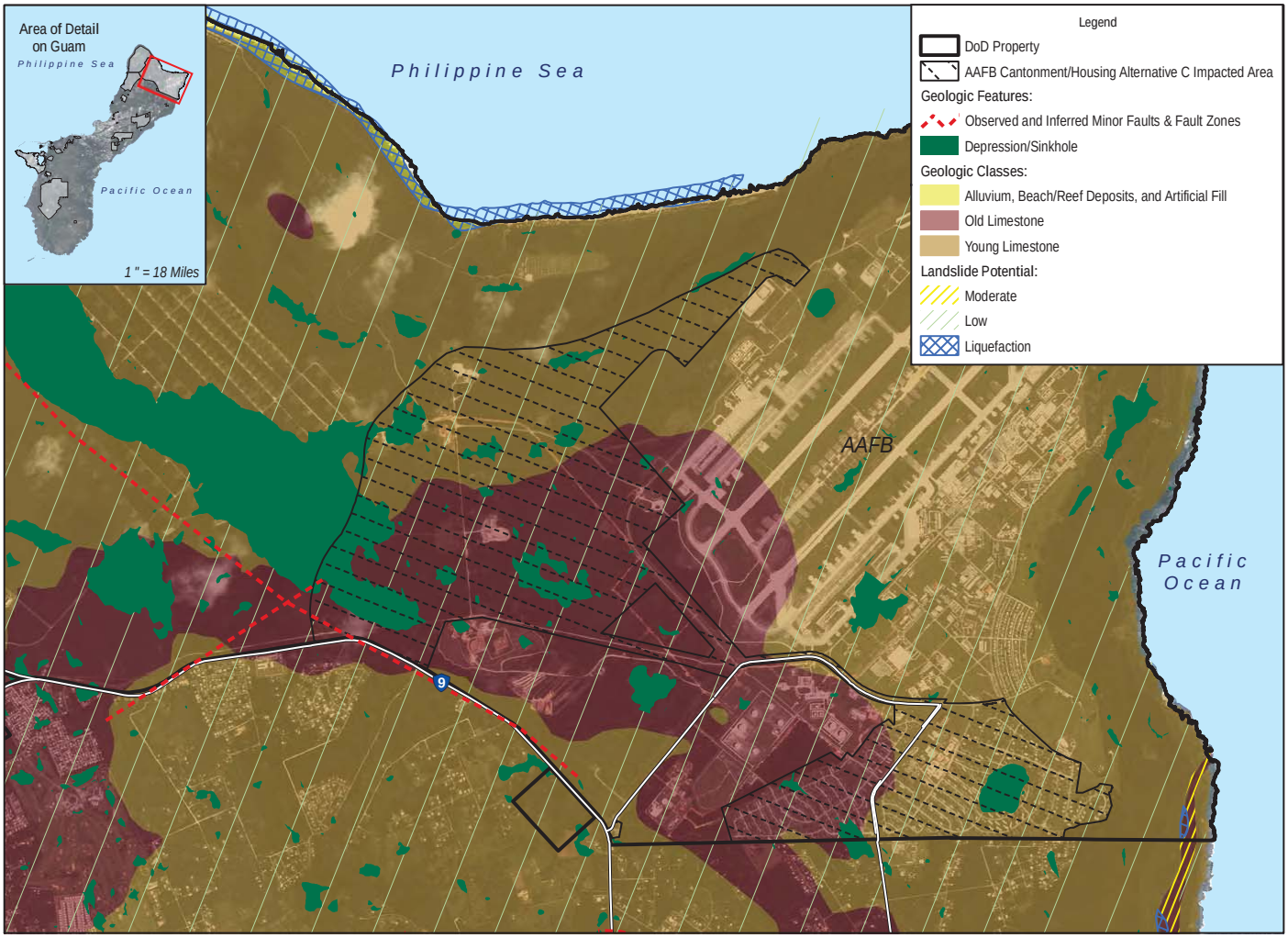


Figure 4.3.1-1
Geologic Features in the Vicinity of
AAFB Cantonment/Housing Alternative C

Sources: COMNAV Marianas 2008; GovGuam 2008; NAVFAC Pacific 2013; WERI 2001

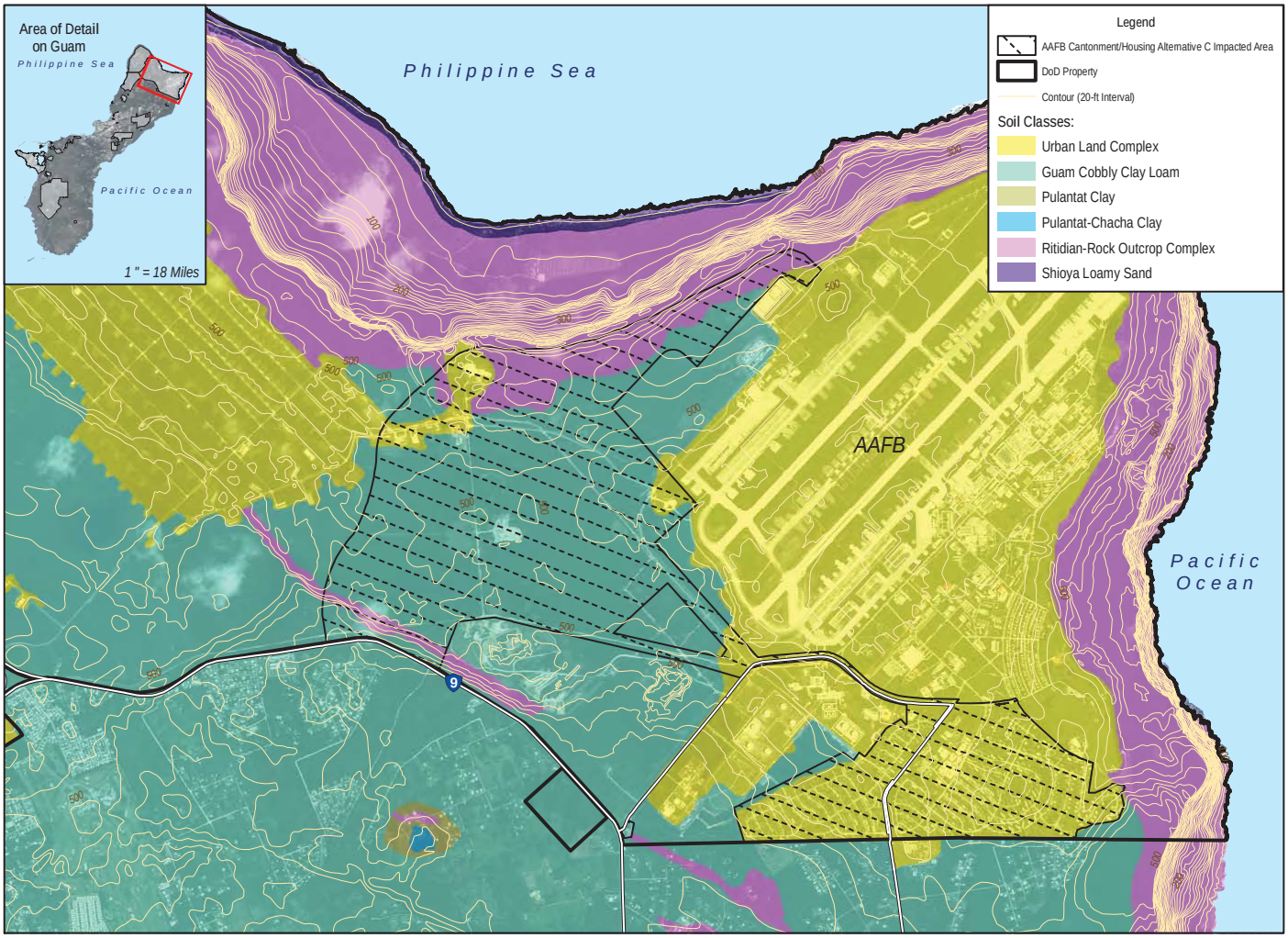


Figure 4.3.1-2
Soils in the Vicinity of AAFB Cantonment/Housing Alternative C

Sources: NAVFAC Pacific 2013; NRCS 2006

4.3.1.2 Environmental Consequences

Potential geology and soil impacts addressed in this section are limited to elements of the proposed action that could affect onshore landforms or that could be affected by geologic hazards. Potential soil contamination issues are addressed in Section 4.3.16.2 of this SEIS (Hazardous Materials and Waste).

Construction

Construction of the new cantonment/family housing, associated support facilities, and roads associated with Alternative C would include the same activities as described for Alternative A. Under Alternative C, construction would occur over a larger area (Table 2.4-3 in Section 2.4-5 of this SEIS). Earthwork for construction of the cantonment/family housing areas and associated infrastructure would include 3,088,000 yd^3 (2,360,945 m^3) of cut (excavation) and 2,485,700 yd^3 (1,900,454 m^3) of fill, resulting in a net of 602,300 yd^3 (460,491 m^3) of cut material available for use as needed. Alternative C would involve the lowest excavation volume of the five action alternatives. Alternative C would involve the lowest excavation volume of the five action alternatives. The Alternative C footprint does not include any substantial grade changes such as steep hills or canyons that would be leveled or filled. Similar to Alternative A, only relatively minor changes in grade are anticipated to provide a buildable surface for construction of buildings, parking lots, and roadways associated with Alternative C. Because construction for Alternative C does not involve major elevation changes, substantially alter the surrounding landscape, affect important geologic features, or diminish slope stability, there would be a less than significant direct, long-term impact to topography and slope stability, for the same reasons as discussed for Alternative A.

Under Alternative C, the same construction activities would take place as under Alternative A, in similar geologic, soil, and seismic conditions. The same BMPs described for Alternative A would be implemented for Alternative C. No prime farmland is identified within the Alternative C project footprint. Therefore, under Alternative C, the construction impacts would be similar to Alternative A: less than significant direct short-term impacts to soils from erosion, and no direct or indirect impacts to agricultural soils. Given compliance with 22 GAR Chapter 10 § 10106F, there would be no adverse impacts to sinkholes. Direct short-term impacts to sinkholes would be less than significant. In addition, direct and indirect short-term impacts associated with geologic hazards would be less than significant.

Under Alternative C, construction of the utility and school expansions that are common to all alternatives would comprise the same activities, and would occur in similar geologic, soil, and seismic conditions as for Alternative A. The same BMPs described for Alternative A would be implemented for Alternative C. Therefore, under Alternative C, the construction impacts of these components would be the similar to Alternative A.

Operation

Under Alternative C, the same residential, recreational, commercial, and administrative uses would take place at the AAFB parcel as under Alternative A, under similar geologic, soil and seismic conditions. Ground disturbance would be minimal and would take place on land that was previously disturbed during the construction phase. No prime farmland is identified within the Alternative C project footprint. The same erosion minimization measures, sinkhole BMPs and seismic design requirements described for Alternative A would apply to Alternative C. Therefore, with the operation phase of Alternative C there would be no impact to topography and slope stability, no direct or indirect impacts to agricultural soils, and less than significant direct, long-term impacts to soils from erosion. Given compliance with 22 GAR Chapter 10 § 10106F, there would be no adverse impacts to sinkholes. This would minimize potential geologic hazards associated with sinkholes and reduce potential direct long-term impacts to sinkholes to

less than significant. Direct and indirect impacts associated with geologic hazards would be less than significant.

Under Alternative C, operation of the utility and school expansions that are common to all alternatives would comprise the same activities, and would occur in similar geologic, soil, and seismic conditions as for Alternative A. The same BMPs described for Alternative A would be implemented for Alternative C. Therefore, under Alternative C, the operational impacts of these components would be similar to Alternative A.

4.3.2 Water Resources

4.3.2.1 Affected Environment

The affected environment for water resources in the Alternative C cantonment/family housing project area is described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.1.2.1: Andersen AFB, pages 4-25 to 4-26). The affected environment for the proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities common to all cantonment/family housing alternatives would be the same as described under Alternative A in Section 4.1.2.1 of this SEIS.

Surface Water

As indicated in the 2010 Final EIS, there are no surface water resources in the AAFB project area. The sinkholes and depressions found at the AAFB site act as stormwater points of discharge. In addition, the use of deep injection wells for stormwater management was prevalent when AAFB was originally developed. Hundreds of these wells are located across the developed portions of the base including the family housing areas. These wells, like the sinkholes and karst fractures, potentially provide direct access to the underground aquifer that pose a risk of aquifer contamination (Figure 4.3.2-1). Existing impervious areas on the AAFB project area amount to approximately 270 acres (111 ha), or 15% of the proposed AAFB impacted area of 1,819 acres (587 ha). Storm runoff from impervious surfaces is currently directed via concrete lined culverts to underground injection control wells, which are permitted and regulated by GEPA. There are no 100-year or 500-year flood zones identified within the proposed AAFB impacted area (Figure 4.3.2-1).

Groundwater

As indicated in the 2010 Final EIS, AAFB overlies the northern portion of three groundwater basins: the Finegayan Basin under the western third of the base; the Agafa-Gumas Basin under the central portion of the base, which includes NWF; and the Andersen Basin under the eastern portion of the base. The AAFB SWPPP protects against groundwater contamination from recharge of stormwater runoff via approximately 100 dry wells that were drilled to facilitate the flow of stormwater into the underlying groundwater. The circumstances concerning the groundwater model developed by the USGS (USGS 2013c), the current well production, and the existing GWA interceptor sewer system are the same as described under Alternative A in Section 4.1.2.1 of this SEIS.

Nearshore Waters

As indicated in the 2010 Final EIS, nearshore waters at AAFB front Tarague Beach and the Pati Point Marine Preserve, which are classified as having M-1 water quality and the use is primarily recreational. The AAFB project area would be served by the Northern District WWTP, which discharges into the Philippine Sea near Tanguisson Beach (see description under Alternative A in Section 4.1.2.1 of this SEIS).

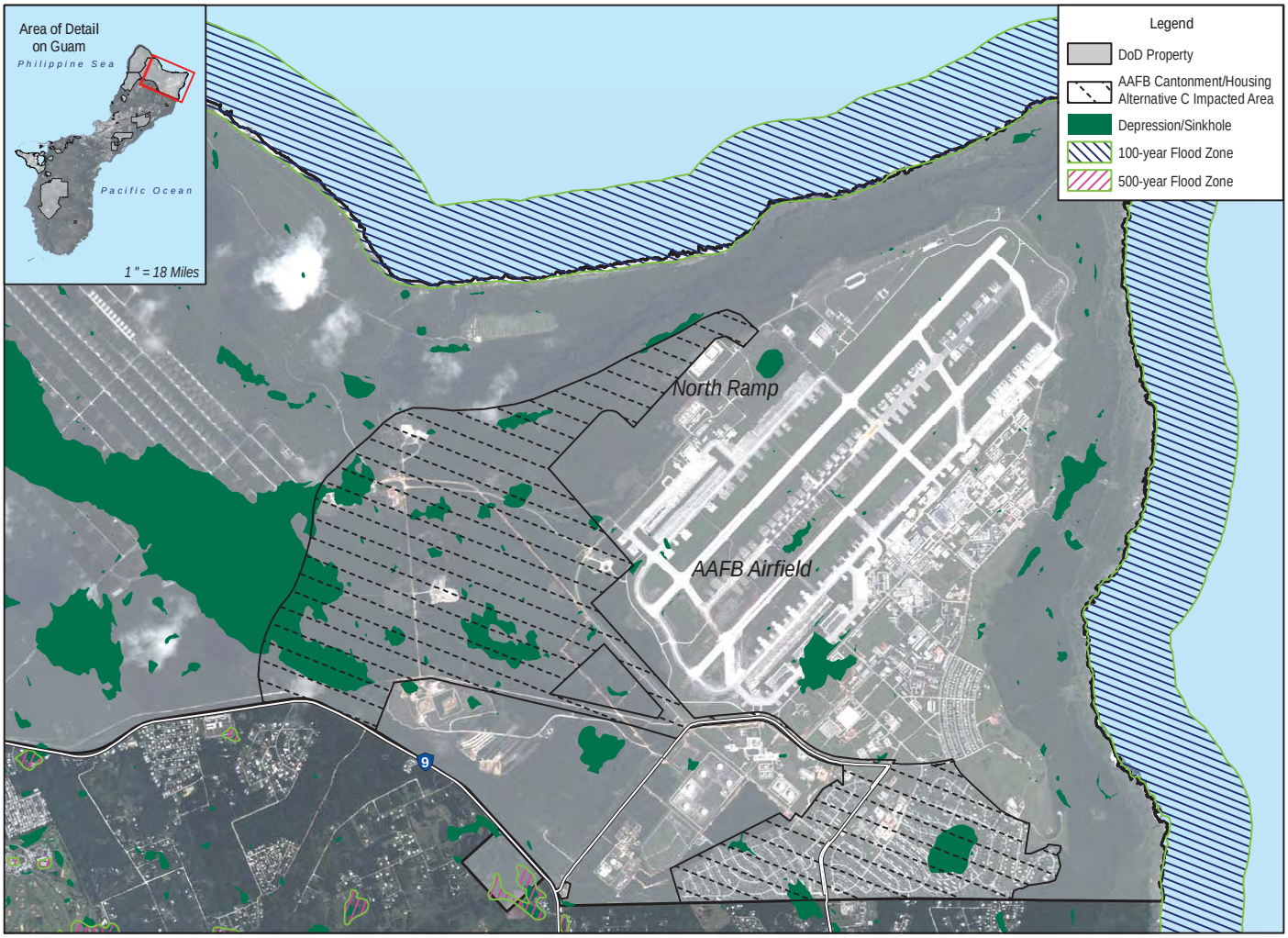


Figure 4.3.2-1
Water Resources in the Vicinity of
AAFB Cantonment/Housing Alternative C

Wetlands

As indicated in the 2010 Final EIS, no wetlands were identified at the AAFB project area.

4.3.2.2 Environmental Consequences

Construction

General construction impacts to water resources under Alternative C would be similar to those described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-84 to 4-88) and under Alternative A in Section 4.1.2.2 of this SEIS. Construction impacts associated with the proposed approximately 11 new wells, school expansions, and off-site utilities common to all cantonment/family housing alternatives would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be no impact to surface water, nearshore waters, and wetlands and less than significant impacts to groundwater for these common elements.

In addition, there would be construction activities associated with the proposed cantonment/family housing at AAFB under Alternative C. Similar to Alternative A, Alternative C would occur in an area that does not contain any waters of the U.S. but would comply with the Construction General Permit, as described under Alternative A.

Construction under Alternative C would result in the potential for short-term increases in stormwater runoff and erosion. However, through compliance with the Construction General Permit and Program SWPPP and implementation of a site-specific SWPPP and associated erosion control, runoff reduction, and sediment removal BMPs (see Table 4.1.2-2), these effects would be minimized and off-site transport of stormwater runoff would be unlikely unless during extreme weather events (i.e., typhoons). Specifically, the site-specific SWPPP would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flowrate of runoff and thereby minimize transport of suspended sediment through settling and promote infiltration of runoff.

Surface Water

No buildings/structures would be constructed in the 100-year or 500-year flood zones and no surface waters are located within or near the proposed construction areas under Alternative C. Given compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely. Therefore, construction activities associated with Alternative C would result in no impacts to surface waters.

Groundwater

Construction activities under Alternative C would include stormwater runoff protection measures that would also serve to protect groundwater quality. By adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific water resource protection requirements, there would be a reduction in stormwater pollutant loading potential and thus a reduction in pollution loading potential to the underlying groundwater basins of the NGLA. As described under Alternative A, an environmental and hydrogeologic assessment for the selected alternative would be performed for sinkholes within the project development footprint to ensure adverse effects to groundwater resources would not occur. Impacts associated with the induced civilian growth and construction/DoD workforce demand on potable water and the construction of the proposed approximately 11 new wells at AAFB would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS.

Potential increases in the rate of sewage spills associated with the induced civilian growth and construction/DoD workforce would result in significant indirect impacts to groundwater quality as described under Alternative A in Section 4.1.2.2 of this SEIS. Mitigation for these impacts would be the same as described in Section 4.1.2.2 for Alternative A.

Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs), the environmental and hydrogeologic assessment for sinkhole protection (if encroachment is unavoidable), siting and construction of wells in accordance with GEPA regulations, minimal increase in water demand or withdrawal from the NGLA during the construction phase, and DoD assistance in identifying funding to upgrade sewer lines, construction activities associated with Alternative C at AAFB would result in less than significant impacts to groundwater.

Nearshore Waters

General construction impacts to nearshore waters would be similar to those described under Alternative A in Section 4.1.2.2 of this SEIS. The AAFB cantonment/family housing alternative would be located at an approximate elevation of 500 feet (150 m) and between 0.2 and 0.5 mile (0.3 and 0.8 km) from nearshore waters (see Figure 4.3.2-1). Given compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely (see discussion of BMPs under *Construction*). In addition, vegetative cover between the construction area and the edge of the steep cliffline and the shoreline would provide an additional buffer and protection from stormwater runoff or sediment reaching nearshore waters. Given adherence to the provisions of the Construction General Permit and implementation of BMPs, it is expected that stormwater runoff, sediment, or other pollutants would not discharge to nearshore waters.

Induced civilian and construction/DoD workforce growth during construction of the cantonment/family housing facilities under Alternative C would increase demand for wastewater treatment at the Northern District WWTP and disposal of generated wastewater. Due to the reduced population projection and related smaller increase in demand under the 2012 Roadmap Adjustments, this increase in wastewater discharge from the Northern District WWTP would be less than under the No-Action Alternative. However, as discussed in Section 4.1.14, Utilities in this SEIS, upgrades to the Northern District WWTP are already needed for the plant to achieve compliance with the treatment standards required by its current NPDES permit. Increasing the wastewater discharge from a non-compliant treatment plant could result in significant indirect impacts to nearshore waters during the period of non-compliance. The significance of nearshore waters impacts resulting from implementation of Alternative C would be similar to that associated with implementing Alternatives A, B, and D. Mitigation for these impacts would be the same as described in Section 4.1.2.2 for Alternative A.

Therefore, with the mitigation to upgrade the Northern District WWTP to treatment systems, the impact to nearshore waters could be beneficial in the long-term because the total volume of wastewater discharge from the Northern District WWTP would receive a higher level of treatment. However, until the WWTP upgrades are completed there would be an indirect and unmitigable significant impact to nearshore waters during construction.

Wetlands

No wetlands are located in or near the construction areas associated with Alternative C. Therefore, construction activities associated with Alternative C would result in no impacts to wetlands.

Operation

Alternative C would incorporate a LID approach in the final planning, design, and construction of the stormwater management system as described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-85 to 4-87) and under Alternative A in Section 4.1.2.2 of this SEIS. Operation impacts associated with the proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities common to all cantonment/family housing alternatives would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be no impacts to surface water, nearshore waters, and wetlands and less than significant impacts to groundwater for these common elements.

The proposed stormwater management system infrastructure improvements included as part of the proposed action would incorporate LID measures and BMPs for compliance with local and federal requirements that are designed to and thus minimize potential impacts to downstream development, sensitive water resources, and ecology, as described under Alternative A in Section 4.1.2.2 of this SEIS. Alternative C would also be implemented in accordance with all applicable orders, laws, and regulations including the preparation and implementation of a SWPPP, SWMP, and SPCC Plans that would control runoff and minimize potential leaks and spills.

Under Alternative C, the total impervious area on the AAFB project area would increase by 126 acres (51 ha). This increase from 15% to 22% impervious area, for a total of 400 acres (162 ha), would result in an associated increase in stormwater runoff volume for each of the design storm events. Alternative C would result in increased runoff of 366 acre-feet (452,000 m^3) and 512 acre-feet (632,000 m^3) from the 25-year and 100-year design storms, respectively. However, the project design would include vegetated swales for conveyance and treatment and detention/retention ponds capable of capturing, storing, and treating additional runoff from the 25-year design storm (see Appendix F for examples of LID applications that would be used and conceptual design of stormwater runoff routing and pond locations). As part of the planning design, the project area was delineated into sub-basins with stormwater conveyance systems to route discharges to appropriately sized detention basins. For each sub-basin, water quality treatment strategies were selected based on the effectiveness of BMPs to treat identified pollutants of concern from proposed land uses within the sub-basin. The selected water quality treatment strategies would achieve reductions of non-point source pollutants to meet the same water quality requirements as identified under Alternative A in Section 4.1.2.2 of this SEIS. In addition, DON would develop and implement a "LID BMP O&M Inspection Checklist" consistent with the 2006 CNMI Guam Stormwater Management Manual to monitor and ensure the effectiveness of LID features during operation. Any deficiencies would be reported to and addressed by the future Public Works Department of the Marine Corps Base Guam.

The final Grading/Drainage/LID Study, dated July 2013, would be provided to the design team for guidance and implementation during design and construction. The designs performed by these contractors would be subject to review by DoD professionals and technical consultants to ensure proper implementation both during design and verification during construction.

Surface Water

No surface waters are located in or near the Alternative C project area and the implementation of an appropriate and comprehensive stormwater management plan utilizing a LID approach would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event. Therefore, Alternative C would result in no impacts to surface waters.

Groundwater

Under Alternative C, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would also serve to protect groundwater quality and recharge. Specifically, implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that the stormwater runoff flowing into infiltration basins and recharging the aquifer would be of acceptable quality.

Compared to Alternative A, there would be similar amounts of secondary limestone forest removed, as (i.e., approximately 1,100 acres [445 ha] for Alternative C vs. 1,000 acres [400 ha] for Alternative A) but less area would be converted to impervious area (i.e., approximately 126 acres [51 ha] for Alternative C vs. 273 acres [110 ha] for Alternative A). Similar to Alternative A, these changes in land cover and impervious area under Alternative C would also result in minor changes to groundwater recharge rates. However, these changes in land cover and impervious area were accounted for during the development of a conceptual level of design for grading, drainage, and LID measures and projected changes in recharge rates would be managed through updating the USGS numerical groundwater model to determine modifications in groundwater pumping, as described under Alternative A. Increased groundwater withdrawal would also be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be short-term, localized significant impacts to the affected basin within the NGLA but less than significant impacts to the overall NGLA. There would be significant but mitigable impacts to groundwater quality from increased flow through the deteriorating GWA interceptor sewer system. Potential mitigations would be the same as described for Alternative A in Section 4.1.2.2 of this SEIS.

Given stormwater runoff protection measures (i.e., implementation of LID and pollution prevention plans); implementation of water conservation measures; groundwater demand from the NGLA that would be substantially less than the sustainable yield; improved management of the NGLA through use of the numerical groundwater model; DoD assistance in identifying funding through the EAC process for an updated and expanded monitoring network; and other potential mitigation measures discussed above, the operations associated with Alternative C would result in less than significant impacts to the overall NGLA; short-term, localized significant but mitigable impacts from groundwater extraction to the affected basin within the NGLA; and significant but mitigable impacts to groundwater quality from the increased flow through the deteriorating GWA interceptor sewer system. NGLA and short-term, localized significant but mitigable impacts to the affected basin within the NGLA.

Nearshore Waters

Under Alternative C, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would ensure that there would be no increase in off-site transport of stormwater runoff, sediment, or other pollutants to nearshore waters for up to the 25-year design storm event. In addition, vegetative cover between the project area and the edge of the steep cliffline and the shoreline would provide an additional buffer and protection from stormwater runoff or sediment reaching

nearshore waters. Therefore, there would be no direct impacts to nearshore waters from stormwater runoff associated with increased impervious areas under Alternative C.

Water resources would be impacted by the increased wastewater discharge from the Northern District WWTP for treatment and disposal of generated wastewater for the operation of cantonment/family housing at AAFB. The associated potential impacts and mitigation would be similar to those described for construction-related impacts. Refer to construction impacts for Alternative A for a detailed discussion of WWTP discharge impacts and mitigation.

Wetlands

No wetlands are located in or near the proposed operational areas under Alternative C. Therefore, operations associated with Alternative C would result in no impacts to wetlands.

4.3.3 Air Quality

4.3.3.1 Affected Environment

Ambient air quality conditions around AAFB are affected primarily by various operational activities occurring at the base and associated stationary and mobile emissions sources. AAFB is considered a major stationary source that requires a Title V operating permit. AAFB is also classified as a Prevention of Significant Deterioration source, based on the level of potential pollutants it may emit. AAFB was issued a Title V Permit to Operate on November 19, 2009 that will expire on November 18, 2014. The issuance of the permit is based on the Title V permit application dated July 2007 and additional information submitted. Activities associated with the Title V permit include the operation of six external combustion units (e.g., boilers), 111 internal combustion units (e.g., emergency generators), 22 fuel storage tanks, 1 concrete crusher, 1 rock crusher, and a landfill facility. A planned wood waste air curtain incinerator and a concrete batch plant are also included in the permit. Table 4.3.3-1 summarizes total emissions from the sources in the Title V permit.

Table 4.3.3-1. AAFB—Stationary Source Permitted Emissions

Total Tons per Year					
SO_2	***CO***	***PM_{10}***	***NO_x***	***VOC***	***HAPs***
525	184	49.6	801	47.5	0.995

Legend: SO_2 = sulfur dioxide; CO = carbon monoxide; PM_{10} = particulate matter (<10 microns); NO_x= nitrogen oxides; VOC= volatile organic compounds; HAPs= hazardous air pollutants.
Notes: Stationary sources include fuel tanks and fuel facilities.
Source: USEPA 2013.

Mobile source emissions are a major component of AAFB's total emissions. On-site mobile emission sources include aircraft, aircraft ground support equipment, private- and government-owned on-road vehicles, and traffic along major highways such as Routes 1, 3, and 9.

4.3.3.2 Environmental Consequences

Construction

The construction phase annual emissions were predicted for Alternative C and are summarized in Table 4.3.3-2. Annual direct emissions would be well below the significance criterion of 250 tpy, as shown in Table 4.3.3-2. The CO_2 emissions during construction period would be less than those analyzed in the 2010 Final EIS resulting in less GHG impacts as compared to the No-Action Alternative.

Table 4.3.3-2. AAFB Cantonment/Family Housing Annual Construction Emissions (2016-2022)

Construction	*Pollutant (tpy)*						
Year	*SO_2*	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
2016	neg	neg	neg	neg	neg	neg	neg
2017	0.0	0.1	0.0	0.0	0.1	0.0	19.4
2018	0.2	9.2	0.6	0.5	7.1	0.9	1585.8
2019	0.6	39.1	2.4	2.1	30.4	4.0	6739.6
2020	0.3	15.4	0.9	0.8	12.0	1.6	2655.0
2021	0.5	30.3	1.8	1.6	23.5	3.1	5219.8
2022	0.5	30.8	1.9	1.7	23.9	3.2	5309.9

Legend: SO_2 = sulfur dioxide; CO = carbon monoxide; PM_{10} = particulate matter (<10 microns); $PM_{2.5}$= particulate matter (<2.5 microns); NO_x= nitrogen oxides; VOC= volatile organic compounds; CO_2 = carbon dioxide; neg = negligible.

Under Alternative C, the maximum emissions year on-site for annual PM levels predicted are slightly less than under Alternative A (see Table 4.1.3-2) (i.e., 2.4 tpy as compared to 2.8 tpy for PM_{10} under Alternative A). Therefore, the short-term on-site hot-spot PM impacts around construction sites would be anticipated as less or similar to those under Alternative A that are shown in Table 4.1.3-3.

As explained in Section 3.3.3, Alternative A is anticipated to have the greatest truck emissions impacts along the truck routes. Off-site on-road vehicle CO, PM, and MSATs hot-spot impact concentrations for Alternative C would be similar in magnitude to those predicted for Alternative A (Section 4.1.3.2) at the analyzed intersections according to similar traffic patterns. Tables 4.1.3-3 and 4.1.3-4 show concentrations for PM and CO during the construction period in comparison to their respective NAAQS. The predicted levels of PM and CO are well below the NAAQS resulting in less than significant short-term PM and CO impacts. Similarly, Tables 4.1.3-6 and 4.1.3-7 show off-site concentrations for MSATs as compared to cancer and non-cancer risks. Maximum estimated increases in cancer risk at any of the receptors due to the project are all less than the threshold criterion of 10 in a million (see Table 4.1.3-6). Therefore, the project impacts of all carcinogenic MSATs are considered acceptable. The maximum chronic hazard index at any of the receptors due to project emissions are well below the target limit of 1 (see Table 4.1.3-7). Therefore, the project impacts of all non-carcinogenic MSATs are also considered acceptable.

Operation

Major Stationary Sources

Because AAFB is a Prevention of Significant Deterioration source, a permit modification could be required as a result of the proposed project. This determination would be made during the final design stage to ensure that the development on AAFB would be in compliance with applicable regulatory requirements.

Mobile Sources

A comparison of traffic congestion conditions, in terms of delay and Level of Service, at these analyzed intersections under Alternative C and Alternative A is provided in Table 4.3.3-3. The congestion conditions under Alternative C would be comparable to Alternative A. Given the low levels of CO and MSATs impact concentrations predicted under Alternative A, the hot-spot impact of off-site on-road vehicle CO and MSATs emissions during operational years would be similar for this alternative as for Alternative A based on the traffic conditions at the intersections analyzed for this alternative. Based on these findings, long-term operational phase air quality impacts under Alternative C are considered less than significant.

Table 4.3.3-3. Comparison of Traffic Congestion Conditions (Operations Year 2030)

Site #	*Worst-case Intersection in Northern, Central, and Southern Guam*	*Alternative C*		*Alternative A*	
		Delay (second)	*Level of Service*	*Delay (second)*	*Level of Service*
1	Route 3/9/Chalan Santa Anita	22.7	C	34.5	D
2	Route 1 / Route 3	73.9	E	90.1	F
3	Route 16 / Route 27	161.9	F	159.0	F
4	Route 1 / Route 14A	>180.0	F	> 180.0	F
5	Route 10 / Route 15	36.2	D	34.6	C
6	Route 1 / Route 2A	23.2	C	23.2	C

4.3.4 Noise

4.3.4.1 Affected Environment

As with Alternatives A and B, the quantified noise impacts around AAFB from the 2013 AAFB AICUZ Study are used as the baseline noise levels for Alternative C. Figure 4.1.4-1 (see Section 4.1.4) shows the noise contours for the 65, 70, 75, 80, and 85 dB DNL contours and Table 4.1.4-1 (see Section 4.1.4) lists the corresponding amount of affected acreage.

In the vicinity of AAFB, noise contours extend off-base to the south and west, and there are populated areas currently within the noise contours up to 70 dB DNL as described in the 2013 AAFB AICUZ Study (Pacific Air Force 2013). Along the AAFB boundary, noise levels range from approximately 65 to 75 dB DNL in line with the end of the runway and dropping back down to below 65 dB DNL near both on- and off-base housing east of the Route 15 family housing gate.

4.3.4.2 Environmental Consequences

Construction

Under this alternative, the cantonment would be located on AAFB between the landfill and the Marine Corps ACE at the north ramp. Construction activities for the cantonment would occur approximately 1,000 feet (304 m) from the nearest residence. Noise in this area due to construction would be approximately 59 dB L_{eq} and well below the short-term evaluation threshold criterion of 75 dBA.

Marine Corps family housing under this alternative would replace existing Air Force family housing in the area currently used for Air Force family housing. The existing (as well as proposed) housing abuts the property line and civilian housing south of the boundary abuts the property line from the south side. As a result, the proposed construction would be within 150 feet (46 m) of residences adjacent to AAFB housing. For Alternatives A and B, it was assumed that construction noise generated by operating ten pieces of heavy equipment would approximate the maximum potential adverse effects. However, for Alternative C, ten pieces of heavy equipment physically cannot operate at the same location 500 feet (46 m) at the same time relative to a receptor. For this alternative, a construction scenario involving five pieces of heavy equipment operating at 150 feet (46 m) and five operating at 200 feet (61 m) is used.

Under this scenario, noise levels would be at 74.8 dBA L_{eq}, above the USEPA threshold guideline of 70 dBA L_{eq}. The 70 dBA L_{eq} threshold is used in this case because the construction would occur in areas with an ambient noise level greater than 60 dBA DNL. Although this represents the maximum potential adverse effect, it would be physically difficult to operate this many pieces of heavy equipment in such tight proximity to each other. However, similar to Alternatives A and B, the construction schedule for proposed action implementation would be spread out. Sequencing work tasks that allows only one or two

pieces of heavy equipment operating in areas close to the nearest receptors would lessen the noise impacts. If only the two loudest pieces of equipment, a grader and a scraper, operated at 150 feet (46 m) and 200 feet (61 m), respectively, noise levels would be 69.4 dBA L_{eq}. Approximately 20 homes housing about 75 people would be affected by noise from the family housing construction. As cantonment/family housing construction noise would be short-term and below the construction threshold guideline, short-term construction noise impacts resulting from implementation of this alternative would be less than significant.

Long-term direct and indirect construction noise impacts consider noise generated throughout the entire duration of construction. Under this alternative, the following three different locations are analyzed: from a residential perspective; from the center of the cantonment area; and from the center of the family housing area. From the perspective of an individual receptor along the southern boundary of AAFB, noise levels above 65 dB would be considered incompatible for long-term land-use noise exposure. Given the equipment list previously estimated in Alternative A, construction would need to be with 525 feet (160 m) to generate noise levels above the 65 dBA FICUN. This level is also considered the limit for annoyance. This distance comprises an insignificant percentage (<1%) of the total construction area and should actually be considered short-term noise exposure because could not possibly last at that level for the entire 10-year period. Therefore, from this perspective, long-term noise from construction within the 525 foot (160 m) zone would be less than significant.

The center of the cantonment area construction activities would be located approximately 4,000 feet (1,220 m) from the AAFB boundary along Route 9. Long-term noise from the cantonment facilities would generate levels of approximately 50.4 dBA. Noise levels due to AAFB aircraft operations in the residential area near Route 9 are less than 65 dBA DNL. Because the difference in noise levels exceed 10 dBA, the greater noise level dominates the noise environment and the long-term construction noise would not alter existing noise levels in the area. Therefore, long-term noise levels due to cantonment construction would be less than significant.

The center of the family housing would be approximately 1,700 feet (518 m) from the southern boundary of AAFB and long-term noise levels would be about 58 dBA and well less than the FICUN criteria. Consequently, short-term and long-term construction noise impacts would be less than significant for Alternative C.

Construction activities common to all alternatives include off-site utilities and school expansions. Impacts due to these common construction projects would be as described in Section 4.1.4.2.

Operation

Similar to Alternatives A and B, long-term noise impacts due to operation of the cantonment/family housing areas at AAFB would be considered less than significant. Aircraft noise generated by aircraft operating at AAFB would continue to affect family housing on AAFB. The proposed housing areas on AAFB would be located just outside the 65 dBA DNL noise zones with approximately the same amount of area in each zone. Details regarding compatibility are provided in Section 4.3.6.2, Land Use, of this SEIS.

Upon full buildup after construction has completed, the steady-state noise generating activities at AAFB would be primarily due to the ongoing aircraft noise. Traffic noise around AAFB would be less than the other cantonment options because there are three primary access roads to AAFB, Route 3/9, Route 1, and Route 15 and an extensive network of roads on-base. Most affected noise receptors identified in the 2010

Final EIS (Volume 6, Chapter 8: Noise, Section 8.6.6.2, pages 8-49 to 8-51) affected by noise levels above 66 dBA could be reduced to below 66 dBA and compliant with the GDPW transportation standards because traffic and resulting noise would only increase about 50% compared to the increase described in the 2010 Final EIS. Noise mitigation improvement such as sound walls would be constructed under the 2010 Final EIS reducing noise impacts in areas that are reasonable and technically feasible. Consequently, direct, long-term noise impacts under Alternative C would be less than significant.

4.3.5 Airspace

4.3.5.1 Affected Environment

Operations and functions under Alternative C consist of support, maintenance/storage, housing, and non-live fire training functions (see Section 2.2.1). There would be no construction or operation activities requiring changes to airspace. Therefore, the affected environment for airspace is only discussed in the context of the LFTRC components of the proposed action (see Chapter 5).

4.3.5.2 Environmental Consequences

As discussed above, there would be no construction or operation activities requiring changes to airspace. Therefore, there would be no impact on airspace from this component of the proposed action.

4.3.6 Land and Submerged Land Use

4.3.6.1 Affected Environment

The affected environment for land use under Alternative C is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.1: Affected Environment, pages 8-19 to 8-25), and is summarized below for reference.

As shown in Figure 4.3.6-1, AAFB and the adjacent submerged lands are federally owned. In summary, there are three main areas of AAFB that are aligned east to west. These are the Main Base to the east, the MSA in the center, and NWF to the west. The proposed action would largely be located within the Main Base and this is the focus of the land use discussion. The Air Force operational facilities are focused around the airfield that is centrally located within the Main Base. Air Force housing and community support are located in the southeast portion of the Main Base. There are land use constraints that affect the Main Base, ESQD arcs associated with the MSA, the accident potential zones (APZs) and noise contours associated with the Main Base airfield, and the training range SDZs (Figure 4.3.6-1).

The off-base community land use south of Main Base family housing and community support is residential and the planned land use continues to be residential. There is a strip of open space along the eastern coastline of AAFB that extends south into the off-base community. The 70 dBA noise contour and APZ generated at the AAFB airfield extend off-base into an area of low-density residential development and open space. The planned land uses within the APZ and noise contour are Park/Open Space and Agriculture. Village Center is the designated land use for the current residential community located south of the western portion of Main Base.

4.3.6.2 Environmental Consequences

Land use impacts are addressed in this section. Land ownership impacts are addressed in Section 4.3.15, Socioeconomics and General Services.

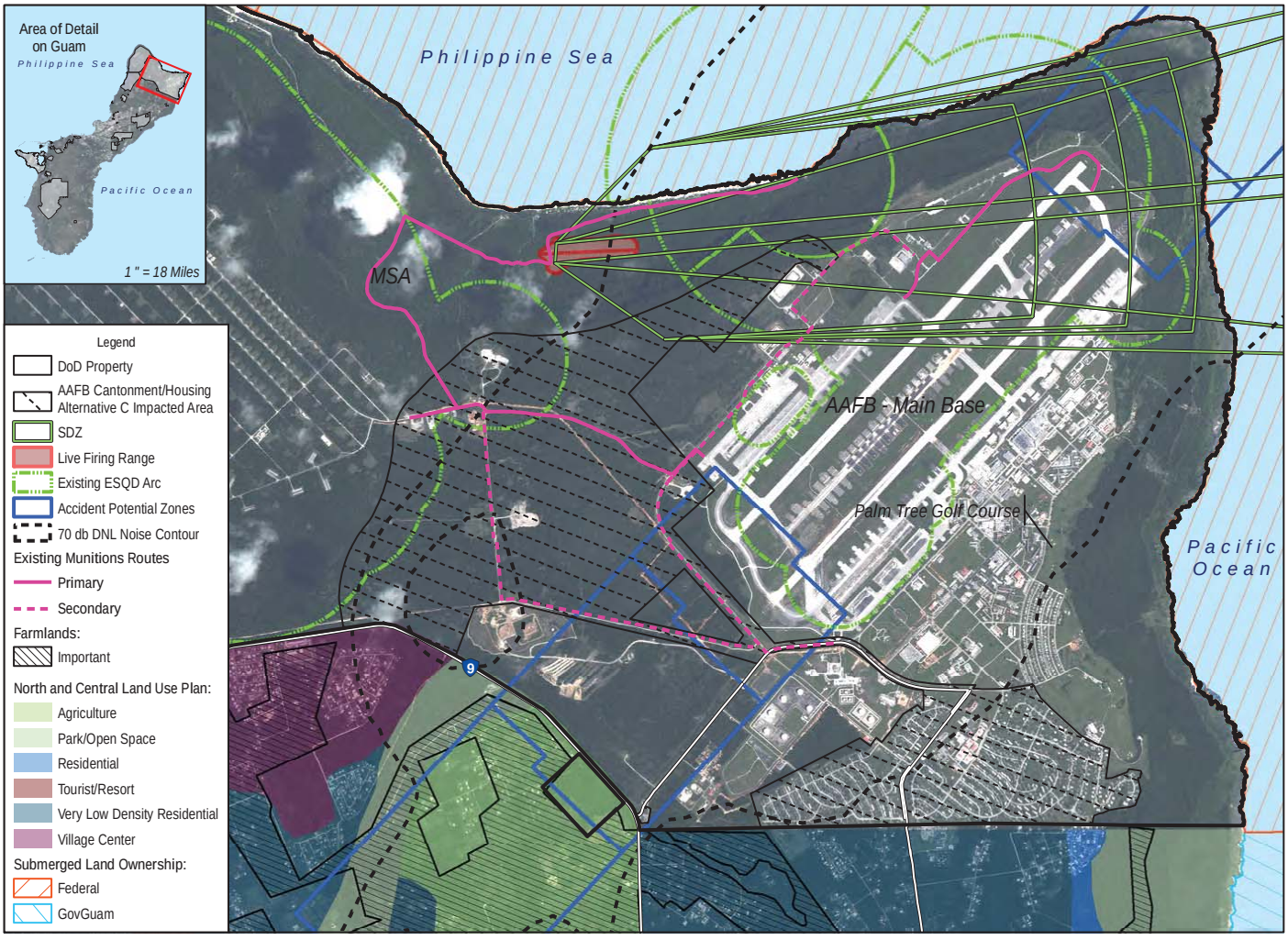


Figure 4.3.6-1
Land Use in the Vicinity of AAFB Cantonment/Housing Alternative C

Sources: DON 2010, NAVFAC Pacific 2013

Construction

As previously discussed in Section 3.6.3.1, Methodology, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource under any of the alternatives.

Operation

The proposed action is generally restricted to AAFB Main Base (except for some education facilities and utility improvements). All cantonment alternatives require water well development on AAFB. The proposed well area is between the MSA and Route 3A in the vicinity of other water wells. There are ESQD arcs that encumber the area. The siting of the water wells was coordinated with AAFB planners. No impacts to land use were identified.

There would be no land use impacts on submerged lands adjacent to AAFB.

The proposed off-base utilities common to all alternatives are as described under Section 4.1.6. In addition to the DoDEA High School expansion common to all alternatives, this alternative proposes repurposing the Andersen Middle School as an elementary school and constructing a new middle school at AAFB. The education facilities would be compatible with surrounding community support land uses and would have no impact on adjacent land use.

The off-base utility improvements specific to this alternative are limited to upgrading the existing sewer along Route 9. There would be no impact on land use resulting from the off-base utility improvements. However, additional inter-base IT/COMM connectivity would be required as described in Chapter 2. This includes the connection between AAFB and the existing Tata cable landing facility in southern Guam, which would require new rights of way along some southern roads and the access road to the Tata facility.

The proposed family housing would require redevelopment and expansion of existing military housing in the southeastern portion of Main Base adjacent to the installation boundary. There would be a long-term loss of open space for the cantonment development and a long-term increase in development density in the housing area. The maximum height of the cantonment buildings would be six stories and the housing would be a maximum of two stories. Open space is incorporated in the design, but there would be less open space than currently exists at the parcel resulting in less than significant direct impacts on land use in the adjacent civilian community. The proposed family housing is consistent with existing land use planning for AAFB. However, as stated in Section 4.3.4.2, Noise, aircraft noise generated by aircraft operating at AAFB would affect family housing on AAFB. The proposed housing would replace the existing housing in the same vicinity.

DoD Guidance discourages housing in areas above 65 dBA DNL and strongly discourages development in 70 dBA or greater. When these constraints are unavoidable, houses may be allowed with the incorporation of noise level reduction design features. Noise level reduction of 25 dBA would be required for 65-69 dBA DNL and 30 dBA for 70-74 dBA DNL, no noise level reduction is required for 60-64 dBA DNL (DOD 2011). The long-term impact of the existing noise levels at AAFB on the proposed housing would be less than significant.

The proposed family housing at AAFB is consistent and compatible with adjacent off-base existing and planned residential land use to the south.

The proposed cantonment is located west of the AAFB airfield. The area sited for the cantonment is within Operational Land Use for the Airfield Environment that includes munitions routes from the MSA to the airfield (see Figure 4.3.6-1). This alternative would limit the future expansion potential of the Air Force operational mission. The proposed action would be located in the interior of the Main Base and would have no impact that would extend off-base. The existing AAFB land use encumbrances on the community would remain (see Section 4.3.4, Noise).

There would be no new access restrictions imposed on the public under this alternative and no impact on access was identified. Alternative C would have less of an impact on land use resources compared to Alternative B.

4.3.7 Recreational Resources

4.3.7.1 Affected Environment

Most of the recreational environment in and around Alternative C has not changed from that described in the 2010 Final EIS. Recreational resources along the coastal area include scenic vistas, Guam NWR Overlay, trails, beaches and parks, and Pati Point Marine Preserve. Recreational resources at AAFB are subject to the same access requirements as other on-base facilities and are therefore restricted to installation personnel and guests. One notable change is the hunting areas on-base. Currently, the areas immediately south of NWF, now known as A1, A2, A3, and A4, are the only hunting areas open on-base and allow for archery hunting only (JRM 2013).

A list of recreational resources at AAFB is contained in the 2010 Final EIS (Volume 2, Chapter 9: Recreational Resources, Section 9.1.2.1: Affected Environment, pages 9-1 to 9-3). Recreational resources found on-base continue to have access restricted to base personnel and guests only. However, future access may change under the 2011 PA with JRM as part of the 2010 Final EIS. Comprehensive descriptions of recreational resources near AAFB are contained in the 2010 Final EIS (Appendix G, Volume 9, Chapter 1, Recreational Resources, Section 1.2.1: Andersen AFB, page G-1-1 to G-1-2). Table 4.3.7-1 identifies the recreational resources near Alternative C.

For this SEIS, uses and geographical areas of proposed development at AAFB are slightly modified from those analyzed in the 2010 Final EIS. These modifications do not result in changes to the recreational environment at or near AAFB. Alternative C divides development into two distinct areas, both located inland from the shore and on the eastern half of the base. The housing area would be constructed and/or replaced contiguous to Palm Tree Golf Course on the southeastern edge of the base. This golf course is not open to the public. The cantonment area would be located closer to the center of AAFB and just southwest of the main base airfield. The addition of approximately 5,000 Marines and approximately 1,300 dependents would put pressure on the existing recreational facilities at AAFB. As part of a Marine Corps base development, outdoor playing fields, a fitness center, a recreational center, an auditorium/theatre, and a youth center would all be constructed to accommodate the needs of the Marines and their dependents.

Table 4.3.7-1. Recreational Resources within the Vicinity of Alternative C

Recreational Resource	*Public Access (Current Status - Future access may change under the 2011 PA with JRM as part of the 2010 Final EIS)*
Beaches (Tarague Basin)	
Tarague Beach, Sirena Beach, Scout Beach	Installation personnel and guests only. Tarague Beach - Open to the public.
Picnic Sites	
Picnic Sites (Family and Individuals)	Installation personnel and guests only. Limited picnic sites open to the public.
Picnic Sites (Large Groups >20)	Installation personnel and guests only.
Camping Area (Tarague Basin)	
Tarague Beach Campsites; Sirena Beach	Installation personnel and guests only.
Scout Beach Campsites	Area open only to scouting groups.
SCUBA Diving and Swimming	
Tarague Beach and Sirena Beach	Installation personnel and guests only to shoreline access for swimming only; no shoreline access for SCUBA diving; boat access to dive sites only).
Pati Point	Public boat access to dive site only, beyond the reef margin.
Hunting	
Game Hunting (Feral Pigs and Deer)	Installation personnel and guests only.
Fishing (Shoreline Pole and Line)	
Guam NWR	Access generally open; restricted public access requires hunting license and special access permit within manageable quotas.
Ritidian Unit of Guam NWR	Open to the public.
AAFB Tarague Basin (Tarague Beach to Pati Beach, except inside designated swimming areas)	Installation personnel and guests only.
Nature Activities	
Hiking Trails	Installation personnel and guests only. Open to public in Ritidian Unit of Guam NWR.
Scenic Drives/Overlooks	
Tarague Beach Road; Ritidian Point Overlook	Open to the public at Ritidian Unit of Guam NWR.
Nature Interpretive Centers	
USFWS Nature Center at Ritidian Unit	Open to the public.
Parks	
Guam NWR	Installation personnel and guests only. Open to public at Ritidian Unit of Guam NWR.
Pati Point Natural Area	Installation personnel and guests only.

4.3.7.2 Environmental Consequences

Construction

The short-term increase of construction-related vehicles on roads may cause delays to persons accessing recreational areas. Staged construction equipment would not obstruct access to, or the use of, the recreational resources, but would inconvenience resource seekers (i.e., potential detours, longer waits, and other similar nuisances). Therefore, short-term less than significant direct impacts to recreational resources would be anticipated.

Operation

Impacts would be similar to those discussed in the 2010 Final EIS. Similar to the 2010 Final EIS, an analysis was made assuming that incoming Marines and dependents would use the recreational resources at AAFB wherever the cantonment/family housing would be constructed. Impacts would be less than those impacts anticipated in the 2010 Final EIS due to the significantly reduced number of users.

Recreational resources at AAFB, including swimming at Tarague Beach and Sirena Beach, may be near carrying capacity. The long-term addition of potential users could result in further congestion of recreation resources at AAFB and other sites on Guam. However, the construction of recreational facilities described in Section 4.3.7.1 of the 2010 Final EIS would ensure that the addition of approximately 5,000 Marines and approximately 1,300 dependents to AAFB would not accelerate the deterioration of the existing recreational resources at AAFB and other sites on Guam. Therefore, direct and indirect long-term impacts to recreational resources would be less than significant.

Alternative C would have a substantially reduced level of impact compared to Alternative D, since it does not have any significant impacts to recreational resources.

4.3.8 Terrestrial Biological Resources

4.3.8.1 Affected Environment

The affected environment for terrestrial biological resources associated with the AAFB cantonment and housing alternative (Alternative C) is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: Andersen AFB, pages 10-16 to 10-31), and is summarized below for reference. This description of the affected environment is supplemented and updated with new information regarding biological surveys within the project areas conducted after the 2010 Final EIS. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for terrestrial biological resources, but it would reduce some potential impacts to terrestrial biological resources as described in the analysis of environmental consequences for Alternative C below. In addition, the biological resources affected environment described in this section includes areas associated with the development of infrastructure common to all alternatives (e.g., off-site utilities).

Vegetation Communities

Vegetation communities on AAFB have been mapped in detail (AAFB 2008b). This mapping was field-verified in 2012 for changes in the occurrence of vegetation communities in that portion of AAFB proposed for use as the cantonment and housing area under Alternative C (see Figure 4.1.8-2). The 2008 mapping was found to accurately represent current vegetation communities in the project areas (NAVFAC Pacific 2013a). Descriptions of the vegetation community types can be found in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: Andersen AFB, pages 10-16 to 10-19). Vegetation communities in other areas required to support the proposed cantonment and housing (e.g., utility corridors) are shown in Figure 4.1.8-2. The mapped community types in these areas have not changed since the 2010 Final EIS. Utility corridors shown on Figures 4.1.8-2, 2.3-5, and 2.3-12 follow roadways, are in high-use areas on developed land, or are in areas with small amounts of herbaceous-scrub vegetation.

Terrestrial Conservation Areas

Much of the undeveloped area of AAFB is within the established Overlay Refuge (see Figure 4.1.8-3). Additional information on Overlay Refuge lands and other terrestrial conservation areas on AAFB within the vicinity of the impacted areas of Alternative C (e.g., HMU) is provided in Section 3.8.1.2 of this SEIS and the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.1.3: Special-Status Species, pages 10-8 to 10-9).

Wildlife - Native Species

The presence of migratory birds and other native wildlife species on AAFB applicable to this alternative was described previously in Section 4.1.8.1.

Special-Status Species: Federal ESA-Listed and Proposed Species

One federal ESA-listed (Mariana fruit bat) and two proposed endangered species (Mariana eight-spot butterfly and *Eugenia bryanii*) occur within the proposed project areas in central and eastern AAFB (Table 4.3.8-1 and Figure 4.1.8-5). Although "suitable habitat" for special-status species is present within the Alternative C project areas, the brown treesnake, the primary factor in the extirpation of special-status wildlife species on Guam and one of the largest obstacles to achieving recovery of special-status species, is still considered abundant and widespread on Guam. Until brown treesnakes are suppressed or removed from at least targeted areas on Guam, the habitat is not in a suitable condition to support the survival of special-status species due to current snake abundance on Guam (e.g., Guam Micronesian kingfisher, Guam rail, Mariana crow) (USFWS 2010a).

A brief summary of each species is provided below, including new information about each species within the project area since the completion of the 2010 Final EIS. Further detail is provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: Andersen AFB, pages 10-24 to 10-31).

Table 4.3.8-1. Distribution of Special-Status Species in Central and Eastern AAFB

Name	*Status**		*Habitat*	*Known to Occur†*	*Comments**
	ESA[d]	*Guam[j]*			
Mammals					
Mariana fruit bat[a, c, m, r, s, t, z]	T	E	Limestone forest, coastal forest, and coconut plantations.	Yes	Few individuals occur throughout AAFB; no known colonial roost sites; recovery habitat present.
Birds					
Mariana swiftlet[a, m]	E	E	Limestone cliffs with caves for roosting and nesting; forages over forest and grasslands.	No	NR; One nest/roost cave at Ritidian Point that was abandoned in late 1970s.
Mariana crow[u, z]	E	E	All forests with a preference for native limestone forest.	No	Extirpated from Guam – last seen on AAFB in 2012; recovery habitat present.
Guam rail[w, z]	E	E	Secondary habitats, some use of savanna and limestone forests.	No	Extirpated from the wild on Guam by 1985; recovery habitat present.
Guam Micronesian kingfisher[v, z]	E	E	Forest and scrub with a preference for native limestone forest.	No	Extirpated from the wild on Guam by 1988; recovery habitat present.
Micronesian starling[a, k, m]	-	E	All habitats but higher density in developed areas.	Yes	Present in the housing area and occasionally observed throughout AAFB.
White-throated ground dove[b, m, n]	-	E	Prefers native limestone and ravine forests	No	Rare observations within the MSA.
Reptiles					
Green and hawksbill sea turtles[a, m]	T E	T E	Suitable beaches for basking and nesting.	No	Only occur on Tarague beach.
Slevin's skink[aa]	PE	E	Within leaf litter in mid-elevation closed humid and montane forests.	No	NR during 2010 and 2012 surveys. Slevin's skink has not been recorded on Guam since 1945 and is believed to be extirpated from Guam.
Moth skink[j, k, l, m]	-	E	Forest areas with large tree trunks.	Yes	Reported in 2009 at one location in proposed utilities area.

Table 4.3.8-1. Distribution of Special-Status Species in Central and Eastern AAFB

Name	*Status**		*Habitat*	*Known to Occur†*	*Comments**
	ESA[d]	*Guam[j]*			
Pacific slender-toed gecko[j, k, l, m]	-	E	Forest edge.	No	Observed in the HMU.
Invertebrates					
Mariana eight-spot butterfly[h, i, k, m, n, o, aa]	PE	-	Intact limestone forest with host plants.	Yes	Host plants, eggs and larvae observed in Tarague Basin during 2013 surveys of project areas.
Mariana wandering butterfly[o, x, aa]	PE	-	Larvae feed on one known host plant species found in native limestone forest habitat.	No	Has not been seen on Guam since 1979 and considered extirpated; single remaining population occurs on Rota, CNMI; host plants observed within impacted areas of AAFB.
Guam tree snail[a, e, m, o, aa]	PE	E	Cool shaded forested areas with high humidity.	No	NR in impacted areas; not observed during 2013 surveys of project areas; observed in Tarague Basin during 2011 surveys.
Humped tree snail[a, f, m, aa]	PE	E			
Fragile tree snail[a, g, m, aa]	PE	E			
Plants					
Serianthes tree[a, b, c, m, p, z]	E	E	Limestone and ravine forests.	No	NR in impacted areas; recovery habitat present.
Heritiera tree[a, b, m, aa]	PE	E	Limestone forest.	No	NR in impacted areas; scattered groups of trees in eastern cliffline areas and in the central portion of the base.
Tabernaemontana rotensis[l, m, q]	PT	SOGCN	Native limestone forest.	Yes	Present within impacted areas.
Cycas micronesica[b, i, k, y, aa]	PT	SOGCN	Limestone areas, ravine forests, and savanna summits.	Yes	NR during 2010 and 2012 surveys; individuals observed adjacent to impacted areas during previous utility project.
Bulbophyllum guamense[aa]	PE	-	Lowland/limestone forests.	No	No known individuals within project areas.
Eugenia bryanii[aa, bb]	PE	-	Windy exposed coastal clifflines in lowland/limestone forests.	No	Currently, *E. bryanii* is known from 6 occurrences on Guam. One individual was observed in July 2014 to the west of the AAFB flightline.
Maesa walkeri[aa]	PE	-	Lowland/limestone forests.	No	No known individuals within project areas.
Nervilia jacksoniae[aa]	PE	-	Lowland/limestone forests.	No	No known individuals within project areas.
Psychotria malaspinae[aa]	PE	-	Lowland/limestone forests.	No	No known individuals within project areas.
Solanum guamense[aa]	PE	-	Lowland/limestone forests.	No	No known individuals within project areas.
Tinospora homosepala[aa]	PE	-	Lowland/limestone forests.	No	No known individuals within project areas.
Tuberolabium guamense[aa]	PE	-	Lowland/limestone forests.	No	No known individuals within project areas.

Legend: - = not listed, E = endangered, NR = not reported, PE = proposed endangered, PT = proposed threatened, T = threatened; SOGCN = Species of Greatest Conservation Need. †Occurrence within AAFB cantonment/family housing or utility project areas.

Sources: [a]Wiles *et al.* 1995; [b]GDAWR 2006; USFWS [c]2010a, [d]2011, [e]2012a, [f]2012b, [g]2012c, [h]2012d; [i]NAVFAC Pacific 2013a; [j]GovGuam 2009; NAVFAC Pacific [k]2010a, [l]2010b; [m]JRM 2013; [n]NAVFAC Marianas 2013b; [o]UoG 2014; [p]USFWS 1994; [q]UoG 2007; [r]JRM *et al.* 2012a; [s]JRM *et al.* 2012b; [t]AAFB 2008b; [u]USFWS 2005; [v]USFWS 2008; [w]USFWS 2009b, BirdLife International 2013; [x]USFWS 2012e; [y]NAVFAC Marianas 2013a; [z]USFWS 2010b; [aa]USFWS 2014a, 2014b; [bb]Personal communication from J. Farley, NAVFAC Marianas, to R. Spaulding, Cardno, regarding *Eugenia bryanii* observation at AAFB, October 29, 2014.

MARIANA FRUIT BAT. The occurrence of this species on AAFB is described in Section 4.1.8.1 and observations are shown on Figure 4.1.8-5. Fruit bat recovery habitat was described by the USFWS in the BO for the Guam and CNMI Military Relocation (USFWS 2010a) and includes the following vegetation types (based on vegetation mapping by the USFS [2006]) for foraging, roosting, and breeding: limestone forest, coconut plantation, ravine forest, and groves of *Casuarina equisetifolia*. Fruit bat recovery habitat is found within proposed project impacted areas associated with Alternative C (see Figure 3.8.3-1).

Recent observations were of single flying and (in a few cases) roosting fruit bats and were most commonly observed in three general regions on AAFB as shown in Figure 4.1.8-5: the cliffline extending from above the CATM Range east to Pati Point; in or near the MSA; and in the vicinity of the HMU (JRM *et al.* 2012a, 2012b). High and medium priority fruit bat roosting habitat as defined in the AAFB *Mariana Fruit Bat Management Plan* are depicted in Figure 4.1.8-5. These areas are based on the location of historic colony roost locations on AAFB and current habitat conditions (AAFB 2008b).

MARIANA SWIFTLET. Although AAFB contains potentially suitable swiftlet foraging habitat, the only known occupied nest/roost caves on Guam are located on NAVMAG more than 20 miles (32 km) south of AAFB. A previously used Mariana swiftlet nest/roost cave is known from Ritidian Point approximately 2 miles (3.2 km) north of the proposed Alternative 3 and support areas; this cave was abandoned by the late 1970s (USFWS 1991). Given that swiftlets forage within 1-3 miles (1.5-5 km) of their nest/roost caves (Jenkins 1983), it is highly unlikely that individuals from the only known population on Guam 20 miles (32 km) away would occur within AAFB. Therefore, as the Mariana swiftlet is not found within the impacted areas associated with Alternative C, this species is not addressed further.

MARIANA CROW. Since 2009, the Mariana crow population on Guam consisted only of two males on AAFB, occurring primarily within the MSA (USFWS 2009c). However, as of 2012, the Mariana crow is considered extirpated in the wild on Guam (Personal communication via letter from USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, HI regarding the DON NOI for Proposed Placement of LFTRC on Guam NWR; December 7, 2012). The closest population of crows is on the island of Rota, approximately 56 miles (90 km) north of Guam. Crows in northern Guam used primary limestone forest for nesting, with nests exclusively in native trees. They have been observed foraging in both primary and secondary limestone forests and tangantangan (USFWS 2005). Crow recovery habitat is found within proposed project impacted areas on Finegayan and in support areas on AAFB and adjacent lands (see Figure 3.8.3-1).

GUAM RAIL. The Guam rail has been extirpated in the wild on Guam since 1985 and exists primarily in captivity on Guam and in mainland zoos. Experimental populations of Guam rails were introduced onto Rota, CNMI in 1989 and onto Cocos Island, off the southern coast of Guam, in 2011 (USFWS 2009b; BirdLife International 2013). The Guam rail prefers edge habitats, especially grassy or secondary vegetation areas which provide good cover; mature forest is deemed only marginal for the Guam rail (USFWS 2009b). Rail recovery habitat within the proposed impacted areas associated with Alternative C includes secondary limestone forest, herbaceous scrub, coconut forest, and tangantangan (see Figure 3.8.3-2).

GUAM MICRONESIAN KINGFISHER. The Guam Micronesian kingfisher was extirpated in the wild by 1988 and is now found only in captivity on Guam and at mainland zoos (USFWS 2008b). Kingfishers utilized a wide variety of habitats including primary and secondary limestone forest, strand forest, coconut forest, edge habitats, and forest openings, but mature forests with tree cavities suitable for nesting may be an important requirement for kingfisher reproduction (USFWS 2008b). Kingfisher recovery habitat within

the proposed impacted areas associated with Alternative C includes primary and secondary limestone forest, coconut forest, and tangantangan (see Figure 3.8.3-1).

SEA TURTLES. Green sea turtle nesting is documented on AAFB at Tarague Beach to the north of the proposed impacted areas (see Figure 4.1.8-5). A total of 49 green sea turtle nests were recorded between Mergagan and Tagua Point from 2005 to 2010, varying from 0 to 11 nests per year. The hawksbill sea turtle has not been definitively determined to nest on Guam (JRM 2013). No sea turtle nesting beaches are within the vicinity of proposed impacted areas associated with Alternative C.

SLEVIN'S SKINK. Originally found on Guam, Cocos Island, Rota, Tinian, Guguan, Alamagan, Asuncion, and Maug, it is now limited to Cocos Island, Sarigan, Guguan, Alamagan, Pagan, and Asuncion. Slevin's skink has not been recorded on Guam since 1945 and is believed to be extirpated from Guam; it is now known to occur only on Cocos Island (an atoll south of Guam) (USFWS 2014a). There are no records of the species within the impacted areas of AAFB. Therefore, as Slevin's skink is not found within the impacted areas of Alternative C, this species is not addressed further.

MARIANA EIGHT-SPOT BUTTERFLY. Mariana eight-spot butterflies and host plants have been reported within the northern portion of the project impacted areas, north of North Ramp, and further north within Tarague Basin (see Figure 4.1.8-5) (JRM 2013; NAVFAC Marianas 2013b; NAVFAC Pacific 2013a; UoG 2014).

MARIANA WANDERING BUTTERFLY. The Mariana wandering butterfly has not been seen on Guam since 1979 and considered extirpated; a single remaining population occurs on Rota, CNMI (USFWS 2013). The only species known to be a Mariana wandering butterfly host plant (*Maytenus thompsonii*) is a common shrub of limestone forests on Guam and has been observed within the impacted areas associated with Alternative C (see Figures 4.1.8-4 and 4.1.8-5) (Moore and McMakin 2001; UoG 2014).

Tree Snails. During surveys conducted in 2011, one colony of Guam tree snails and fragile tree snails was observed in backstrand and *Neisosperma* forest vegetation at the east end of Tarague Basin to the north of the impacted areas (see Figure 4.1.8-5) (NAVFAC Marianas 2013b). No tree snails were observed within the impacted areas associated with Alternative C during 2013 surveys conducted for this SEIS (UoG 2014). Therefore, as tree snails are not found within the impacted areas of Alternative C, these species are not addressed further.

SERIANTHES TREE. The only known locations of *Serianthes* on Guam are outside of the impacted lands considered under this alternative: a single tree at NWF and two saplings at Tarague Basin (JRM 2013). However, recovery habitat does occur within the impacted areas of AAFB (see Figure 3.8.3-2).

HERITIERA LONGIPETIOLATA. This tree is found in crevices of rough limestone in primary limestone forest on the eastern side of AAFB along eastern escarpments and in the north-central area of AAFB (see Figure 4.1.8-5). Three mature trees are present just outside the proposed north-central project footprint (north of North Ramp); none have been recorded within the Alternative C impacted areas (AAFB 2008b; NAVFAC Pacific 2010, 2013a; USFWS 2014b). Therefore, as *H. longipetiolata* is not found within the impacted areas of Alternative C, this species is not addressed further.

TABERNAEMONTANA ROTENSIS. The distribution of this species was evaluated on AAFB in 2007 (UoG 2007). Over 21,000 *T. rotensis* individuals were found throughout AAFB at 265 mapped locations, primarily in the central portion of the base and near the limestone cliffs in the northeast (see Figure 4.1.8-2). The species is present in the proposed cantonment/family housing and water well development areas (AAFB 2008b; NAVFAC Pacific 2010, 2013a; USFWS 2014b).

CYCAS MICRONESICA. The cycad is found in many limestone forests throughout Guam, including AAFB, and is proposed as an endangered species under the ESA because of the Asian cycad scale insect that is devastating the species. A number of individual cycads were observed and transplanted during the construction of a utility corridor along the southern boundary of Alternative C near North Ramp on AAFB. Therefore, there is a high potential for *Cycas* to occur in adjacent similar habitat within the impacted area of Alternative C (NAVFAC Marianas 2013a) (see Figure 4.1.8-2).

BULBOPHYLLUM GUAMENSE. An epiphyte in the orchid family, this species occurs in mat-like formations on tree branches of coastal lowland/limestone forests. Currently there are 8 known occurrences on Guam, totaling fewer than 250 individuals (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of AAFB (USFWS 2014b). Therefore, as *B. guamense* is not found within the impacted areas of Alternative C, this species is not addressed further.

EUGENIA BRYANII. A perennial shrub in the myrtle family, the species is known only from the island of Guam. Historically, *E. bryanii* is known from windy exposed coastal clifflines and along the Pigua River, in lowland/limestone forests. Currently, *E. bryanii* is known from 6 occurrences totaling fewer than 420 individuals (USFWS 2014a, 2014b). Only one occurrence is within the proposed project areas – one individual plant was observed in July 2014 to the west of the southern end of the AAFB flightline (Figure 4.1.8-5) (Personal communication from J. Farley, NAVFAC Marianas, to R. Spaulding, Cardno, regarding *Eugenia bryanii* observation at AAFB, 29 October 2014).

MAESA WALKERI. A shrub or small tree in the primrose family typically found in limestone forests, this species is known from only two individuals on Guam – one individual on Mt. Lamlam and one individual on Mt. Almagosa (USFWS 2014a). There are no records of the species within the impacted areas of AAFB (USFWS 2014b). Therefore, as *M. walkeri* is not found within the impacted areas of Alternative C, this species is not addressed further.

NERVILIA JACKSONIAE. A small herb in the orchid family, this species is found in lowland/limestone forests. On Guam, *N. jacksoniae* is known from 2 occurrences totaling fewer than 200 individuals: one occurrence near the UoG campus and 1 occurrence to the northwest of Tarague Beach (see Figure 4.1.8-5) (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of AAFB (USFWS 2014b). Therefore, as *N. jacksoniae* is not found within the impacted areas of Alternative C, this species is not addressed further.

PSYCHOTRIA MALASPINAE. A shrub or small tree in the coffee family, this species is found in lowland/limestone forests. Currently, *P. malaspinae* is known from five occurrences: one individual at Ritidian Point within the Guam NWR, one individual at Pågat Point, one individual at the base of Mt. Almagosa, and two individuals at NWF (USFWS 2014a, 2014b). None of these individuals have been observed within the last 5 years. A specimen collected from the Ritidian NWR in August 2013 is currently pending identification (USFWS 2014a). There are no records of the species within the impacted areas of AAFB (USFWS 2014b). Therefore, as *P. malaspinae* is not found within the impacted areas of Alternative C, this species is not addressed further.

SOLANUM GUAMENSE. A small shrub in the nightshade family that occurs within limestone forests. Currently, *S. guamense* is known from a single occurrence of one individual on Guam (USFWS 2014a). There are no records of the species within the impacted areas of AAFB (USFWS 2014b). Therefore, as *S. guamense* is not found within the impacted areas of Alternative C, this species is not addressed further.

TINOSPORA HOMOSEPALA. A vine in the moonseed family found in limestone forests. Currently, *T. homosepala* is known from 3 occurrences totaling approximately 300 individuals: one occurrence on the

western side of Asan Ridge; a second occurrence near the War in the Pacific Historical Park; and a third occurrence on the cliff face at Hagåtña (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of AAFB (USFWS 2014b). Therefore, as *T. homosepala* is not found within the impacted areas of Alternative C, this species is not addressed further.

TUBEROLABIUM GUAMENSE. An epiphyte in the orchid family found in limestone forests. Currently, *T. guamense* is known from three occurrences on Guam: two occurrences within the NAVMAG and one in the northeastern area of Finegayan (see Figure 4.1.8-4) (NAVFAC Pacific 2010; USFWS 2014a, 2014b). There are no records of the species within the impacted areas of AAFB (USFWS 2014b). Therefore, as *T. guamense* is not found within the impacted areas of Alternative C, this species is not addressed further.

Special-Status Species: Guam-Listed Species and SOGCN

Two Guam-listed endangered species (Micronesian starling and moth skink) occur within the proposed project areas in central and eastern AAFB (see Table 4.3.8-1 and Figures 4.1.8-2 and 4.1.8-5); those species that are Guam-listed or Guam SOGCN that are also federally listed or proposed for listing under the ESA were discussed previously.

MICRONESIAN STARLING. The starling is present in the housing area at AAFB (JRM 2013; J. Savidge, Colorado State University, personal communication to G. Metzler, Cardno TEC, May 23, 2013) and has also been observed occasionally throughout AAFB (NAVFAC Pacific 2010; JRM *et al.* 2012d; JRM 2013) (see Figure 4.1.8-5).

WHITE-THROATED GROUND DOVE. Although the white-throated ground dove is considered extirpated from Guam due to the brown treesnake (GDAWR 2006), it is seen on very rare occasions on AAFB, primarily within the MSA and in the southeastern corner of AAFB (JRM *et al.* 2012a, 2012b; NAVFAC Marianas 2013b; UoG 2014). Observed individuals are thought to be transients from Rota (GDAWR 2006; NAVFAC Marianas 2013b) and a resident or breeding population does not occur on Guam. The white-throated ground dove was not seen or heard during surveys of the action area in 2009, 2012, and 2013 (NAVFAC Pacific 2010, 2013a, 2013b; UoG 2014). Therefore, as the white-throated ground dove is not found within the impacted areas of Alternative C, this species are not addressed further.

MOTH SKINK AND PACIFIC SLENDER-TOED GECKO. Although both species have been observed within AAFB, only the moth skink has been observed within proposed project impacted areas along the southern boundary of the base (see Figure 4.1.8-5) (NAVFAC Pacific 2010). Moth skinks and slender-toed geckos have also been observed by USGS biologists within the HMU (R. Reed, USGS Brown Treesnake Project, personal communication, April 24, 2013). Based on surveys within proposed impacted areas on AAFB in support of the 2010 Final EIS and this SEIS (NAVFAC Pacific 2010, 2013a), there are no known occurrences of the Pacific slender-toed gecko within the Alternative C impacted areas. Proposed water well utilities would avoid the HMU where the Pacific slender-toed gecko is known to be present. Therefore, as the Pacific slender-toed gecko is not found within the impacted areas of the AAFB Cantonment/Family Housing Alternative, this species is not addressed further.

4.3.8.2 Environmental Consequences

Construction

Vegetation. The vegetation communities that would be impacted during proposed facility and infrastructure construction activities under Alternative C are shown within the impact footprint in Figure 4.1.8-2. Under Alternative C, 138 acres (56 ha) of primary limestone forest and 1,039 acres (420 ha) of secondary limestone forest would be removed during proposed construction activities (Table 4.3.8-2),

primarily associated with the cantonment and housing activities on AAFB. Approximately 89 acres (36 ha) of other plant communities, primarily herbaceous scrub, and 771 acres (312 ha) of developed areas would also be impacted.

Table 4.3.8-2. Direct Construction-Related Impacts to Vegetation Communities with Implementation of Cantonment/Family Housing Alternative C

Project Component	*Vegetation Community (acres [ha])*							
	PLF	***SLF***	***TT***	***HS***	***CF***	***CP***	***Dev***	***Total***
AAFB cantonment and family housing	136.5 (55.2)	967.9 (391.7)	0	71.9 (29.1)	0	0	642.4 (260.0)	**1,818.7 (736.0)**
Utility corridor specific to Alternative C	0.2 (<0.1)	7.8 (3.2)	0	2.2 (0.8)	0.2 (0.1)	0.1 (<0.1)	11.0 (4.5)	**21.5 (8.7)**
Utility corridors and water well areas common to Alternatives A-E	1.5 (0.6)	63.0 (25.5)	4.5 (1.8)	9.6 (3.9)	0	0	89.9 (36.4)	**162.5 (65.8)**
High School/ Middle School Expansions	0	0	0.3 (0.1)	0	0	0	27.7 (11.2)	**28.0 (11.3)**
Total	**138.2 (55.9)**	**1,038.7 (420.3)**	**4.8 (1.9)**	**83.7 (33.9)**	**0.2 (0.1)**	**0.1 (<0.1)**	**771.0 (312.0)**	**2,030.7 (821.8)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; TT =tangantangan; HS = herbaceous scrub; CF = *Casuarina* forest; CP = coconut plantation; Dev = developed.

Native limestone forest, both primary and secondary, has been significantly reduced on Guam due to past and ongoing actions including extensive disturbance during and after WWII, widespread planting of non-native species; and impacts from non-native ungulates; development; fire; and deforestation. As stated in Section 3.8.1.1, limestone forests on Guam are important since they retain the functional ecological components of native forest that provide important habitat for the majority of Guam's native species, including ESA-listed, ESA-proposed, and Guam-listed species and Guam SOGCN, as well as maintaining water quality and reducing fire risk. Non-native forest communities (e.g., tangantangan, *Vitex*) significantly alter the forest structure, composition, and resilience to other disturbance processes and do not provide the conditions suitable for native flora and fauna species to persist (Morton *et al.* 2000; GDAWR 2006; Guam Department of Agriculture 2010; JRM 2013).

Of the 18,538 acres (7,502 ha) of primary and secondary limestone forest found on Guam, approximately 13,110 acres (5,305 ha) are found primarily within AAFB, Finegayan, and the NAVMAG (USFS 2006). Under Alternative C, approximately 138 acres (56 ha) of primary limestone forest and 1,039 acres (420 ha) of secondary limestone forest would be removed (Table 4.3.8-2). Therefore, given the importance of limestone forest habitat for native species and the continuing loss of native limestone forest across Guam, the conversion of 1,177 acres (476 ha) of limestone forest on AAFB to developed area would be a significant but mitigable impact to the regional vegetation community and its function.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on vegetation communities with implementation of Alternative C. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of biosecurity outreach and education.

- *Contractor Education Program*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the contractor education program.
- *Onsite Vegetation Waste Management Procedures*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the vegetation waste management procedures.
- *DON Guam Landscaping Guidelines*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of landscaping guidelines.
- *Contractor Plans and Specifications*. All construction would occur within the limits of construction shown in the project figures.

Potential Mitigation Measures

To mitigate for significant impacts to limestone forest, the DON proposes to implement forest enhancement on a minimum of 1,177 acres (476 ha) limestone forest. Forest enhancement would include but is not limited to the following actions:

- Ungulate management consisting of exclusion fencing and active control (i.e. trapping, snaring, shooting) with the goal of eradication within the fenced areas.
- Non-native, invasive vegetation removal.
- Propagation, planting, and establishment of native species that are characteristic of native limestone forest habitats (e.g., *A. mariannensis, G. mariannae, F. prolixa, M. citrifolia, W. elliptica*).

The degradation and loss of primary limestone and other forest habitats resulting from ungulate damage and invasion by alien plant species has substantially diminished the extent of habitat for native species in the Mariana archipelago. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including special-status species. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Terrestrial Conservation Areas. The only terrestrial conservation area within the impacted areas of Alternative C is Overlay Refuge (see Figure 4.1.8-3). Overlay Refuge lands were established for the purpose of conserving and protecting ESA-listed species and other native flora and fauna, maintaining native ecosystems, and the conserving native biological diversity, recognizing that the primary purpose of lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force.

Under Alternative C, approximately 894 acres (362 ha) of Overlay Refuge lands would be impacted (Table 4.3.8-3), or 4.1% of the total Overlay Refuge lands on Guam. This area overlaps with the vegetation communities discussed previously. The majority (845 acres [342 ha]) is associated with the cantonment and housing component within AAFB and is predominantly primary and secondary limestone forest (Table 4.3.8-3 and Figure 4.1.8-2). Therefore, because proposed construction activities would convert 894 acres (362 ha) of Overlay Refuge lands to developed areas, this would be a significant loss to the conservation function of these lands and implementation of Alternative C would result in significant but mitigable impacts to terrestrial conservation areas.

Table 4.3.8-3. Direct Construction-Related Impacts to Overlay Refuge with Implementation of Cantonment/Family Housing Alternative C

Project Component	*Overlay Refuge (acres [ha])*					
	PLF	***SLF***	***HS***	***CP***	***Dev***	***Total***
AAFB cantonment and housing	116.9 (47.3)	621.1 (251.3)	29.1 (11.8)	0	77.6 (31.4)	**844.7 (341.8)**
Utility corridor specific to Alternative C	0	4.1 (1.7)	0	0.1 (<0.1)	0.1 (<0.1)	**4.3 (1.7)**
Utility corridors and water well areas common to Alternatives A-E	0	36.7 (14.9)	0	0	8.1 (3.3)	**44.8 (18.2)**
Total Overlay Refuge Impacted	**116.9 (47.3)**	**661.9 (267.9)**	**29.1 (11.8)**	**0.1 (<0.1)**	**85.8 (34.7)**	**893.8 (361.7)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; TT =tangantangan; HS = herbaceous scrub; CF = *Casuarina* forest; CP = coconut plantation; Dev = developed.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on terrestrial conservation areas with implementation of Alternative C. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

The same BMPs discussed previously under *Vegetation* would be implemented for terrestrial conservation areas.

Potential Mitigation Measures

To mitigate for significant impacts to terrestrial conservation areas, the DON would submit a proposal to CNO Energy and Environmental Readiness Division to designate an ERA on the NAVMAG to conserve native limestone forest in southern Guam which provides habitat for special-status species. The DON has defined an ERA as a physical area or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural, physical, and biological processes to prevail without human intervention. However, under unusual circumstances, deliberate manipulation (e.g., removal or control of invasive species) may be utilized to maintain the unique feature that the ERA was established to protect (NAVFAC 1996). The proposed NAVMAG ERA would encompass approximately 553 acres (234 ha). Although the proposed NAVMAG ERA is currently part of the Overlay Refuge, implementation of these potential mitigation measures would provide an increased level of protection by further ensuring this area is maintained in natural and near natural conditions and to have available such areas for research and scientific manipulation (NAVFAC 1996; NAVFAC Marianas 2010).

In addition, the DON proposes to submit a proposal to CNO Energy and Environmental Readiness Division to expand the existing Orote ERA by approximately 32 acres (13 ha) of terrestrial habitat. The Final Orote ERA Expansion proposal was completed FY 2013 and will be submitted for approval in 2014.

Wildlife - Native Species. Native bird species reported for AAFB are predominantly migratory shorebird species and primarily use open areas such as grassy fields. The proposed construction at AAFB and support areas would not reduce the amount of these open space areas. The conversion of forested areas to open areas and the proposed construction for utility corridors would result in additional open space. The loss of woody vegetation would result in the loss of nesting areas for the yellow bittern, but this loss

would not result in significant adverse effects on the bittern population on Guam because suitable nesting habitat occurs throughout the island. Short-term construction noise may temporarily impact suitable habitat for some birds in the vicinity of the construction areas, but they would relocate to other open and forested areas on AAFB, and could return to the area following construction. Implementation of Alternative C would not have a significant adverse effect on a population of any migratory bird species or other native wildlife species. Non-listed native reptiles are abundant throughout Guam and impacts to vegetation communities under Alternative C would result in less than significant impacts to non-listed native reptile populations.

Therefore, as presented above, long-term, direct impacts to populations of native wildlife species would not result because these species are abundant in surrounding areas and could repopulate portions of suitable habitat within the affected area after construction. Therefore, direct impacts to native wildlife would be less than significant with implementation of proposed construction activities associated with Alternative C.

Proposed construction activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. To prevent the inadvertent spread of non-native species on Guam or to other locations off of Guam, the DON would implement standard biosecurity measures (e.g., HACCP, brown treesnake interdiction measures, coconut rhinoceros beetle vegetation management procedures, outreach/education, and monitoring to evaluate effectiveness of HACCP) into construction protocols, procedures, and activities.

The following BMPs would be implemented to avoid and minimize potential direct, long-term impacts of proposed construction activities on native wildlife with implementation of Alternative C.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under *Construction, Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

With implementation of these BMPs, including development of HACCP plans and ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species (e.g., coconut rhinoceros beetle), the risk of the introduction and establishment of new or spread of existing non-native species on Guam is substantially reduced. Therefore, there would be less than significant impacts to native wildlife species related to the potential introduction and establishment of non-native species with implementation of proposed construction activities associated with Alternative C.

Damage of forested areas, particularly primary and secondary limestone forests, by non-native ungulates (i.e., deer and pigs) is a serious concern on Guam. Under Alternative C, removal of large amounts of secondary limestone forest currently used by ungulates would displace and concentrate ungulates into adjacent areas, resulting in even higher densities and potentially greater habitat damage. Potential impacts from changes in ungulate densities from construction projects within the

same or similar habitat areas as proposed in this SEIS were addressed in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-115).

The implementation of the potential mitigation measures under the *Vegetation* section above would also benefit native wildlife species. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. Approximately 1,159 acres (469 ha) of Mariana fruit bat recovery habitat would be removed due to proposed construction activities at AAFB under Alternative C (Table 4.3.8-4). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.3.8-4. Summary of Permanent Construction-Related Impacts to Mariana Fruit Bat Recovery Habitat with Implementation of Cantonment/Family Housing **Alternative C**

Project Component	***Recovery Habitat (acres [ha])***
AAFB cantonment and housing	1,110.0 (449.2)
Utility corridor specific to Alternative C	4.9 (2.0)
Utility corridors and water well areas common to Alternatives A-E	43.9 (17.8)
Total Recovery Habitat Impacted	**1,158.8 (469.0)**

Additional potential direct impacts to the Mariana fruit bat from construction activities are based on the distances from those activities that are likely to cause disturbance to this species (e.g., noise, human activity, lighting). The evaluation of fruit bat disturbance is based on the approach used by USFWS in previous ESA section 7 formal consultations and associated BOs (e.g., USFWS 2006b, 2010a). These distances are: roosting habitat within 492 feet (150 m) and foraging habitat within 328 feet (100 m) from the activity (Wiles, personal communication 2006 and Janeke, personal communication 2006, respectively, as cited in USFWS 2006b).

The species is currently limited to the few areas on Guam away from human activities and with suitable habitat, primarily on federal lands on NAVMAG and AAFB (JRM *et al.* 2012a, 2012b; JRM 2013; A. Brooke, NAVFAC Marianas, personal communication). Although it appears that fruit bats are frequently observed within the proposed Alternative C impacted area to the north and southwest of North Ramp (see Figure 4.1.8-5), the clusters of fruit bat detections are an artifact of the number of station count surveys conducted in that particular location. No more than two fruit bats have been observed in flight during each detection during recent surveys at AAFB (JRM *et al.* 2012b, c, d). However, illegal hunting, loss and degradation of native forest, predation by the brown treesnake, and the increased extirpation risk owing to the high vulnerability of very small populations continue to impact the potential recovery of the species on Guam (USFWS 2010a; JRM 2013). Based on the equilibrium/carrying capacity of snakes on Guam (Rodda and Savidge 2007), implementation of the proposed action is not expected to increase the likelihood of predation by the brown treesnake on Mariana fruit bats.

Although the loss of 1,159 acres (469 ha) of fruit bat recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, it would reduce the total number of bats that the island can support. Given this loss of recovery habitat and the critically low numbers of bats on Guam, there would be significant but mitigable impacts to the Mariana fruit bat.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on Mariana fruit bats with implementation of Alternative C. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Pre-Construction Surveys*. Surveys would be completed within suitable fruit bat habitat 1 week prior to onset of construction activities following the USFWS-approved JRM protocol. If a fruit bat is present within 492 feet (150 m) of the project site, the work must be postponed until the bat has left the area.
- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all new roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

Potential Mitigation Measures

The same potential mitigation measures discussed previously under *Vegetation* (i.e., forest enhancement of 1,177 acres [476 ha] of limestone forest) would be applicable for the Mariana fruit bat and its recovery habitat. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana fruit bat. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

MARIANA CROW. The Mariana crow is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the crow is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the crow, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative C, impacts to the crow would be limited to recovery prospects. If crows are reintroduced and exposed to construction activities under Alternative C, they may be disturbed (DON 2014).

Although the crow no longer occurs on Guam, approximately 1,162 acres (470 ha) of crow recovery habitat would be removed due to proposed construction activities on AAFB under Alternative C (Table 4.3.8-5). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.3.8-5. Summary of Permanent Construction-Related Impacts to Mariana Crow Recovery Habitat with Implementation of Cantonment/Family Housing Alternative C

Project Component	*Recovery Habitat (acres [ha])*
AAFB cantonment and housing	1,112.7 (450.3)
Utility corridor specific to Alternative C	5.3 (2.1)
Utility corridors and water well areas common to Alternatives A-E	43.9 (17.8)
Total Recovery Habitat Impacted	**1,161.9 (470.2)**

Proposed construction activities under Alternative C would result in the loss of 1,201 acres (486 ha) of crow recovery habitat on Guam. Although this loss of recovery habitat on Guam would not preclude the recovery of the crow should it be reintroduced to Guam in the future, it would reduce the total number of crows that the island can support. If and when the crow is reintroduced to Guam, the best available information indicates project-related noise would not further reduce the amount of recovery habitat suitable for this species' breeding, feeding and sheltering (USFWS 2010a). Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Mariana crow.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of the Mariana crow with implementation of Alternative C. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 1,177 acres [476 ha] of limestone forest) would be applicable for the Mariana crow and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana crow, should it be reintroduced to Guam in the future.

GUAM RAIL. The Guam rail is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the rail is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the rail, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the rail is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative C, impacts to the rail would be limited to recovery prospects. If rails are reintroduced and exposed to construction activities under Alternative C, they may be disturbed (DON 2014).

Although the rail no longer occurs on Guam, approximately 228 acres (92 ha) of rail recovery habitat would be removed due to proposed construction activities on AAFB under Alternative C (Table 4.3.8-6). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.3.8-6. Summary of Permanent Construction-Related Impacts to Guam Rail Recovery Habitat with Implementation of Cantonment/Family Housing Alternative C

Project Component	*Recovery Habitat (acres [ha])*
AAFB cantonment and housing	174.5 (70.6)
Utility corridor specific to Alternative C	9.1 (3.7)
Utility corridors and water well areas common to Alternatives A-E	44.3 (17.9)
Total Recovery Habitat Impacted	**227.9 (92.2)**

Although this loss of recovery habitat on Guam would not preclude the recovery of the rail should it be reintroduced to Guam in the future, it would reduce the total number of rails that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam rail.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of the Guam rail with implementation of Alternative C. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 1,177 acres [476 ha] of limestone forest) would be applicable for the Guam

rail and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam rail, should it be reintroduced to Guam in the future.

GUAM MICRONESIAN KINGFISHER. The kingfisher is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the kingfisher is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the kingfisher, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the kingfisher is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative C, impacts to the kingfisher would be limited to recovery prospects. If kingfishers are reintroduced and exposed to construction activities under Alternative C, they may be disturbed (DON 2014).

Although the kingfisher no longer occurs on Guam, approximately 1,159 acres (469 ha) of kingfisher recovery habitat would be removed due to proposed construction activities at AAFB under Alternative C (Table 4.3.8-7). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.3.8-7. Summary of Permanent Construction-Related Impacts to Guam Micronesian Kingfisher Recovery Habitat with Implementation of Cantonment/Family Housing Alternative C

Project Component	*Recovery Habitat (acres [ha])*
AAFB cantonment and housing	1,110.0 (449.2)
Utility corridor specific to Alternative C	4.9 (2.0)
Utility corridors and water well areas common to Alternatives A-E	43.9 (17.8)
Total Recovery Habitat Impacted	**1,158.8 (469.0)**

Although this loss of recovery habitat on Guam would not preclude the recovery of the kingfisher should it be reintroduced to Guam in the future, it would reduce the total number of kingfishers that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam Micronesian kingfisher.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the recovery of the Guam Micronesian kingfisher with implementation of Alternative C. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.

- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 1,177 acres [476 ha] of limestone forest) would be applicable for the kingfisher and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam Micronesian kingfisher, should it be reintroduced to Guam in the future.

SEA TURTLES. The green and hawksbill sea turtles potentially nest along Tarague Beach to the north of the project areas. All cantonment and housing components would be constructed on the upper plateau area of AAFB. Construction personnel are issued base passes for official business only within proposed construction areas; these restrictions are specified in construction contracts. Use of Tarague Beach is not expected to increase as a result of construction activities; therefore, there would be no impacts from construction personnel to sea turtles that may occur on the Tarague Beach.

To avoid and minimize any potential impacts to nesting sea turtles from proposed facility lighting associated with the construction of the cantonment/family housing area on AAFB, appropriate lighting would be installed (e.g., hooded lights would be used to avoid and minimize the illumination of coastline areas; see Section 2.8). In addition, implementation of the potential mitigation measures described above under *Vegetation* (i.e., forest enhancement of 1,177 acres [476 ha] of limestone forest) would also benefit the survival of sea turtles. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species. Therefore, there would be no impacts to the sea turtle nesting beach at Tarague with implementation of the proposed construction activities associated with Alternative C.

MARIANA EIGHT-SPOT BUTTERFLY. The two known host plant species for the eight-spot butterfly have not been reported within the Alternative C impacted area and there are no records of the species within the AAFB support areas. However, given the proximity of the eight-spot butterfly area to observations immediately to the north of the project area (see Figure 4.1.8-5) and the high mobility of the species, the species is likely to occur within the larger AAFB area.

Some species of tropical butterflies have well-developed ears on their wings and can detect sounds at the same frequencies that humans can hear. It is hypothesized that the butterflies are listening to the flight sounds or foraging calls of predatory birds (Lane *et al.* 2008; Yack 2012). Given the low numbers of forest birds currently on Guam due to the brown treesnake, masking of the flight sounds or foraging calls of predatory birds due to noise from proposed construction activities would not make eight-spot butterflies more susceptible to predation.

With implementation of appropriate BMPs to avoid and minimize potential impacts to eight-spot butterflies (e.g., pre-construction butterfly and host plant surveys within the proposed construction

footprint and salvage/relocation of host plants, larvae or eggs; see Section 2.8), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed construction activities associated with Alternative C. In addition, implementation of the potential mitigation measures described above under *Vegetation* (i.e., forest enhancement of 1,177 acres [476 ha] of limestone forest) would also benefit the survival the eight-spot butterfly. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species, including eight-spot butterfly host plants.

SERIANTHES TREE. Although individual *Serianthes* trees do not occur within the impacted areas of Alternative C, approximately 1,1093 acres (442 ha) of *Serianthes* recovery habitat would be removed due to proposed construction activities at AAFB under Alternative C (Table 4.3.8-8). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.3.8-8. Summary of Permanent Construction-Related Impacts to *Serianthes* Recovery Habitat with Implementation of Cantonment/Family Housing Alternative C

Project Component	*Recovery Habitat (acres [ha])*
AAFB cantonment and housing	1,052.5 (425.9)
Utility corridor specific to Alternative C	4.9 (2.0)
Utility corridors and water well areas common to Alternatives A-E	35.8 (14.5)
Total Recovery Habitat Impacted	**1,093.2 (442.4)**

Although this loss of recovery habitat would not preclude the recovery of *Serianthes* on Guam, given the loss of recovery habitat, there would be significant but mitigable impacts to the recovery of *Serianthes* on Guam.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of *Serianthes* with implementation of Alternative C. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See the above discussion of BMPs under *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 1,177 acres [476 ha] of limestone forest) and the Mariana crow would also benefit *Serianthes* recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, outplanting of native species, and rodent control. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including *Serianthes*.

TABERNAEMONTANA ROTENSIS. Approximately 63 clusters of the SOGCN *T. rotensis* are located within the Alternative C impacted areas, primarily in the northern and western areas of the proposed cantonment area (see Figure 4.1.8-2). Under Alternative C, all *T. rotensis* would be avoided to the maximum extent practicable during proposed construction activities. In addition, high-value (both biologically and culturally) plant species such as *T. rotensis* could be salvaged during construction activities and translocated to suitable habitat on AAFB (see Section 2.8). Therefore, with implementation of these BMPs (e.g., avoidance, or salvage and translocation), there would be less than significant impacts to *T. rotensis* with implementation of the proposed construction activities associated with Alternative C.

CYCAS MICRONESICA. With implementation of appropriate BMPs to avoid and minimize potential impacts to cycads (e.g., pre-construction surveys within the proposed construction footprint and salvage/relocation of plants), there would be less than significant impacts to the *Cycas micronesica* with implementation of proposed construction activities associated with Alternative C.

EUGENIA BRYANII. Currently, *E. bryanii* is known from 6 occurrences totaling fewer than 420 individuals (USFWS 2014a, 2014b). Only one occurrence is within the proposed project areas – one individual plant was observed in July 2014 to the west of the southern end of the AAFB flightline (Figure 4.1.8-5) (Personal communication from J. Farley, NAVFAC Marianas, to R. Spaulding, Cardno, regarding *Eugenia bryanii* observation at AAFB, October 29, 2014). The potential loss of 1 individual out of a population of approximately 400 individuals on Guam would not be a significant impact. However, under Alternative C, the individual *E. bryanii* could be salvaged during construction activities and translocated to suitable habitat on AAFB (see Section 2.8). Therefore, with implementation of this BMP (e.g., salvage and translocation), there would be less than significant impacts to *E. bryanii* with implementation of the proposed construction activities associated with Alternative C.

Special-Status Species: Guam-Listed and SOGCN

MICRONESIAN STARLING. The Micronesian starling is present in an existing housing area (see Figure 4.1.8-5) that would be redeveloped to accommodate the new housing area on AAFB. An additional small area in central AAFB that supports starlings would be developed as part of the proposed cantonment under Alternative C (see Figure 4.1.8-5). During proposed construction and demolition activities, some Micronesian starlings would relocate to other suitable areas on AAFB, particularly to the north and south of the proposed cantonment/family housing area. To the maximum extent practicable, the mature palm trees that starlings use for nesting and roosting within the existing housing area would not be removed during the proposed construction activities. Construction and demolition would also occur in phases, thereby not impacting the entire starling population within the existing housing area at one time. After construction, starlings could return to the new cantonment/family housing area. It is also expected that the new cantonment/family housing area may potentially increase the area of suitable habitat on AAFB, by increasing potential nesting habitat (i.e., man-made structures, palm trees, areas with brown treesnake control). Therefore, as the loss of a portion of existing Micronesian starling habitat on AAFB would be temporary and there would be an increase in starling habitat during and after construction, there would be less than significant impacts to the Micronesian starling with implementation of proposed construction activities associated with Alternative C.

WHITE-THROATED GROUND DOVE. Although considered extirpated from Guam, the white-throated ground dove is observed on AAFB on rare occasions (JRM *et al.* 2012a, 2012b; NAVFAC Marianas 2013b). Considered extirpated from Guam since the 1980s, the primary cause of its extirpation and lack of reestablishment on Guam is due to predation by the brown treesnake (GDAWR 2006). It has not been reported in the proposed impacted areas associated with Alternative C, only in other areas on AAFB

including the MSA and the southeastern corner of AAFB. Therefore, there would be no impacts to the white-throated ground dove with implementation of the construction activities associated with Alternative C.

MOTH SKINK. Surveys conducted in 2010 and 2012 in support of the 2010 Final EIS and this SEIS, detected a single moth skink in 2012 within secondary limestone forest in a proposed utilities area along the southern border of AAFB (NAVFAC Pacific 2010, 2013a) (see Figure 4.1.8-5). Therefore, due to the extremely low occurrence of the skink within the proposed impacted areas, there would be less than significant impacts to the species with implementation of proposed construction activities associated with Alternative C.

Operation

Operational impacts would only occur for the proposed cantonment and housing at AAFB. Operational requirements for the proposed utilities would require only periodic, limited maintenance activities along established utility corridors and impacts to biological resources would be less than significant. Consequently, only the potential operational impacts at the proposed AAFB cantonment and housing areas are evaluated below.

Vegetation. With implementation of BMPs and potential mitigation measures (see Section 2.8), including invasive species outreach and education, ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species, and applicable elements of the Strategic Implementation Plan (SIP), the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the cantonment and housing area under Alternative C is considered unlikely. Therefore, there would be less than significant impacts to vegetation with operation of the proposed cantonment and housing area at AAFB under Alternative C.

Terrestrial Conservation Areas. After construction of the cantonment and housing areas under Alternative C, the majority of remaining designated Overlay Refuge lands on AAFB would remain undeveloped. There would be no impact to Overlay Refuge lands with operation of the proposed cantonment and housing area at AAFB under Alternative C.

Wildlife - Native Species. Potential impacts to wildlife were evaluated in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-101) for a similar proposed action but impacting a larger area, and were found to be less than significant.

Lighting along the perimeter of the cantonment and housing area would be hooded or shielded to the maximum extent practicable to prevent unnecessary light beyond operational areas. Proposed operational activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. To prevent the inadvertent spread of non-native species on Guam or to other locations off of Guam, the DON would implement standard biosecurity measures (e.g., brown treesnake interdiction measures, outreach/education, and 1-year post-construction monitoring to evaluate effectiveness of HACCP) into operational procedures and activities. Therefore, there would be less than significant impacts to wildlife due to proposed operation of the cantonment and housing areas under Alternative C.

However, the following BMPs would be implemented to avoid and minimize potential indirect, long-term impacts of proposed operational activities on native wildlife with implementation of Alternative C.

Best Management Practices

- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.
- *Prevention of Free-Roaming Cats and Dogs*. See Section 4.1.8.2, Operation, *Wildlife - Native Species* for a detailed description of the BMPs to avoid and minimize potential impacts of free-roaming cats and dogs on native wildlife.

With implementation of these BMPs, including ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species, and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the risk of the introduction and establishment of new or spread of existing non-native species on Guam is substantially reduced.

Continued implementation of the potential mitigation measures under the Construction, *Vegetation* (i.e., forest enhancement of 1,204 acres [488 ha] of limestone forest) and *Special-status Species* sections above would also benefit native wildlife species and habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species. Therefore, there would be less than significant impacts to native wildlife species related to the introduction and establishment of non-native species due to operational activities associated with Alternative C.

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. Potential impacts to the Mariana fruit bat from operational activities are based on the distances from operations that are likely to cause disturbance to this species (e.g., noise, lighting, and general human disturbance). These are the same distances that were previously discussed for construction impacts. This acreage of fruit bat recovery habitat would continue to be impacted from operational activities of the cantonment and housing area at AAFB after construction activities have ceased.

Operation of the proposed cantonment and housing areas under Alternative C would result in significant but mitigable impacts to fruit bats due to potential direct disturbance (e.g., noise, lighting, general human disturbance) to fruit bats within 492 feet (150 m) of the cantonment/family housing area. The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential long-term impacts of proposed operational activities on the Mariana fruit bat with implementation of Alternative C.

Best Management Practices

- *Lighting Installation*. Lighting would be designed to meet minimum safety, AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

Potential Mitigation Measures

- Continued implementation of the potential mitigation measures under the Construction, *Vegetation* and *Special-status Species* sections above would also benefit the Mariana fruit bat and recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, outplanting of native species, and brown treesnake research and suppression.

MARIANA CROW, GUAM RAIL, AND GUAM MICRONESIAN KINGFISHER. These species are extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of these species is reasonably certain to occur and the species are likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of these species, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow, rail, and kingfisher are successfully re-introduced and then have the potential to be exposed to cantonment and housing operational activities under Alternative B, there would be no impact to these species. If the species are reintroduced and exposed to cantonment and housing operational activities under Alternative C, they may be disturbed.

SEA TURTLES. As discussed previously under construction impacts, to avoid and minimize any potential impacts to nesting and potential hatchling sea turtles from proposed facility lighting at AAFB, hooded lights would be used to the maximum extent practicable at all new roads and facilities near coastline areas. Illumination of coastline areas would be kept to an absolute minimum.

Increased recreational use of Tarague Beach by military and civilian personnel associated with the proposed cantonment and housing facilities at AAFB could potentially impact sea turtles using the beach and nearshore waters. The implementation of the BMPs and potential mitigation measures under the Construction, *Vegetation* and *Terrestrial Conservation Areas* sections above would benefit the survival of sea turtles (e.g., reducing erosion, reducing nest predation by rodents). In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Free-roaming pets are not permitted on DON installations. All pets must be either kept indoors or, when outside, on a leash and collar or within a cage or fenced yard. This policy would prevent potential impacts to nesting sea turtles from harassment, injury or mortality from free-roaming pets. Therefore, there would be less than significant impacts to nesting sea turtles at Tarague Beach due to operations associated with Alternative C.

MARIANA EIGHT-SPOT BUTTERFLY. As operations would not occur outside of the cantonment/family housing area on AAFB, Mariana eight-spot butterflies or their host plants would not be impacted. Therefore, there would be no operational impacts to the Mariana eight-spot butterfly with implementation of Alternative C.

EUGENIA BRYANII. As there are no known occurrences of *E. bryanii* within AAFB, there would be no impacts to this species with implementation of operations under Alternative C.

TABERNAEMONTANA ROTENSIS AND *CYCAS MICRONESICA*. Operational activities within the Alternative C cantonment/family housing area would not disturb or impact *T. rotensis* and *C. micronesica*. Therefore, there would be no impacts to *T. rotensis* and *C. micronesica* due to operations associated with Alternative C.

Special-Status Species: Guam-Listed and SOGCN

MICRONESIAN STARLING. Starlings are adapted to human presence and associated activities based on their ability to nest and forage in housing areas. Therefore, there would be no operational impacts to starlings under Alternative C.

WHITE-THROATED GROUND DOVE. Although considered extirpated from Guam, the white-throated ground dove is observed on AAFB on rare occasions (JRM *et al.* 2012a, b; NAVFAC Marianas 2013b). The white-throated ground dove has not been reported in the Alternative C impacted areas. Therefore, there would be no impacts to the white-throated ground dove due to operations associated with Alternative C.

MOTH SKINK. Surveys conducted in 2010 and 2012 for the 2010 Final EIS and this SEIS detected a single moth skink in 2012 within secondary limestone forest in a proposed utilities area along the southern border of AAFB (NAVFAC Pacific 2010, 2013a) (see Figure 4.1.8-5); moth skinks have not been detected within or adjacent to the impacted areas of Alternative C. Therefore, due to the extremely low occurrence of the skink within the proposed impacted areas, there would be no impacts to the species with implementation of the operational activities associated with Alternative C.

4.3.9 Marine Biological Resources

4.3.9.1 Affected Environment

The affected environment for marine biological resources associated with the proposed AAFB cantonment/housing alternative is found in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1), but it is summarized below for reference. The reduction in the number of Marines and dependents that would be relocated to Guam does not result in any changes to the affected environment for marine resources, but it may further decrease some impacts determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, and is therefore incorporated in the subsequent analysis of environmental consequences for the alternatives below.

Marine Flora and Invertebrates

With respect to Guam as a whole, coral cover and diversity are typically highest in the area beginning roughly at Falcona Beach on the northwest coast, continuing clockwise around the northern coast and extending down to Pågat Point on the eastern coast (2010 Final EIS, Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.5.1: Andersen AFB, pages 11-42 to 11-43).

The area around AAFB contains a narrow fringing reef, much of which is an algal reef, in a high-energy environment. The northern tip of Guam is bordered by a nearshore narrow fringing reef composed primarily of coralline algae on the eastern end and corals on the western end (Figure 4.3.9-1). The shallows of the reef flat and the intertidal areas are primarily populated by macroalgae and seagrasses, respectively.

Fish

The description of fish based on the AAFB Marine Resources Preserve Baseline Survey of Marine Resources conducted in 1993 and 1994 has not changed since the 2010 Final EIS. However, total fish biomass at 133 sites around Guam was measured during the NOAA Pacific Islands Fisheries Science Center Coral Reef Ecosystem Division surveys, which measured relatively high concentrations of surveyed fish in the marine environment to the northeast of AAFB relative to the rest of Guam and other regions with marine protected areas (preserves and reserves). Of this fish biomass, the northeastern region of Guam showed a relatively high proportion of herbivores in comparison to much of the rest of Guam, especially the southwestern coast (Williams *et al.* 2012). A low concentration of herbivores may cause or exacerbate a switch to a benthos more heavily dominated by non-accreting algae, while a high proportion of herbivores (as found in the northeastern region) helps maintain a healthy coral reef ecosystem by keeping algal growth in check.

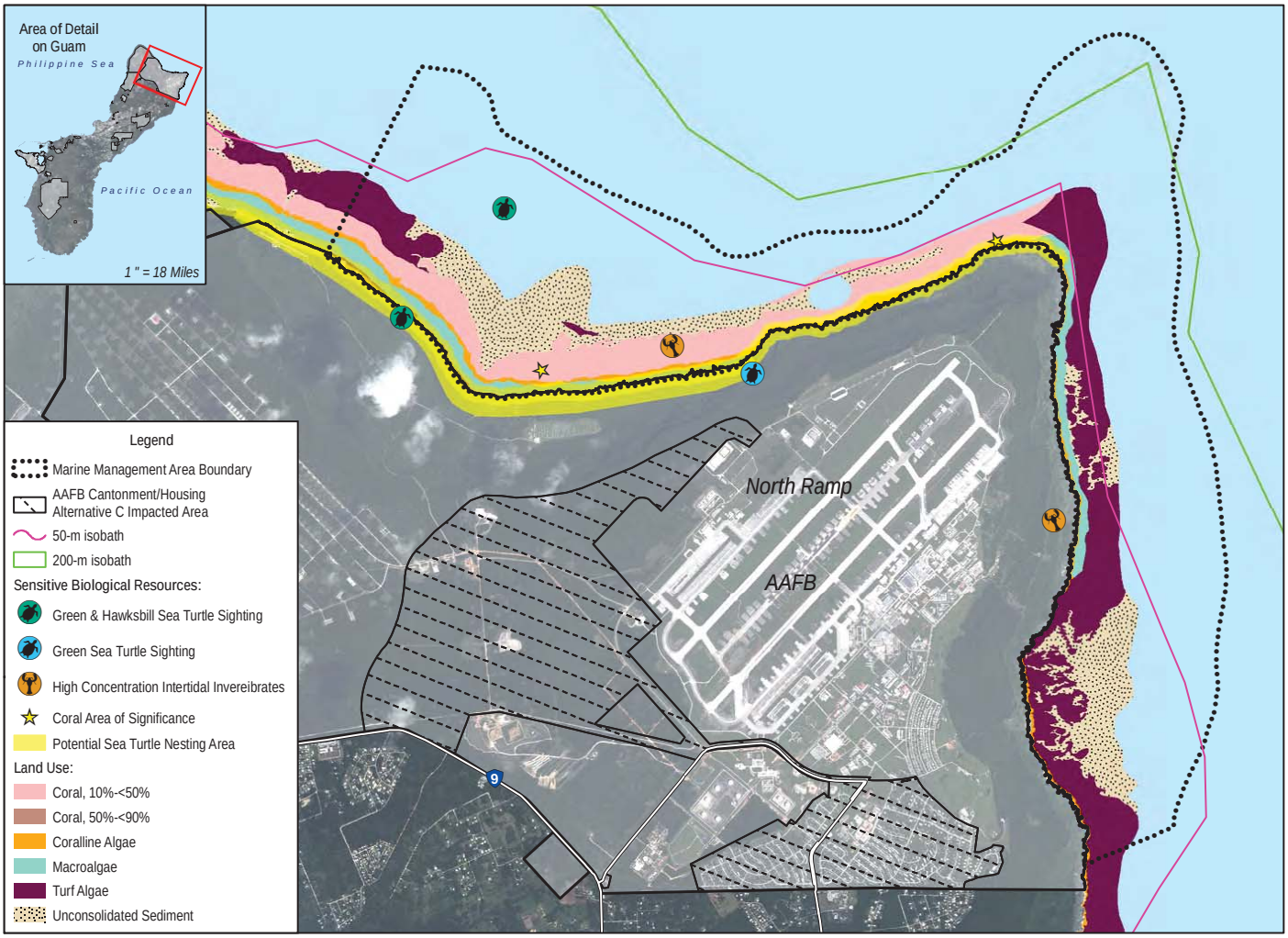


Figure 4.3.9-1
Overview of Sensitive Marine Biological Resources
and Nearshore Habitat – AAFB Cantonment/Housing Alternative C

Sources: NOAA 2005a, b; NAVFAC Pacific 2013

The extent to which the coastal waters off AAFB are used for commercial, recreational or subsistence fishing has not been determined. However, NOAA reported that, as of 2006, there was no evidence of shallow-water bottomfish overfishing around Guam (71 FR 64474 November 2, 2006). The region northeast of AAFB had a high observance of large, carnivorous fish (including sharks, jacks, emperors, groupers, humphead wrasse, and parrotfish) relative to the other surveyed sites around Guam (Williams *et al.* 2012).

Essential Fish Habitat

EFH-designated habitat areas for AAFB are those defined for bottomfish, crustaceans, coral reef ecosystems, precious corals, and Pacific pelagics. The description of EFH based on the AAFB Marine Resources Preserve Baseline Survey of Marine Resources conducted in 1993 and 1994 has not changed since the 2010 Final EIS. The marine environment around AAFB supports a rich diversity of species associated with the coral reef complex including fish, corals and other invertebrates, and algae.

Special-Status Species

Two of the coral species listed as threatened under the ESA are found at the Guam NWR at Ritidian Point or are thought to possibly occur there based on observations of those species in other areas of Guam (Burdick 2012, 2013). Information on the presence of these coral at nearby preserves AAFB Marine Resource Preserve and Pati Point Marine Preserve is lacking, but for the purposes of this SEIS, these same coral species listed in Table 4.3.9-1 are assumed to be present at these preserves as well.

Table 4.3.9-1. Coral Species Listed under ESA Potentially Occurring or Known to Occur at the Guam NWR, Ritidian Point

Scientific Name	*Abundance / Habitat*	*Comments*
Acropora globiceps	Not Available	Occurs in Guam waters and within the marine waters of the Ritidian Unit – Guam NWR.
Seriatopora aculeata	Rare to uncommon, typically found in exposed seaward reef slope zones.	Typically occurs in areas where sedimentation rates are low, however, noted in Guam along the southwestern coast where sedimentation rates were high.

Sources: Burdick 2012, 2013; Personal communication from V. Brown, Pacific Islands Regional Office Habitat Conservation Division, Guam Field Office, NMFS, to S. Hanser, Marine Biologist, NAVFAC Pacific regarding occurrences of threatened coral species in Guam waters, February 2015.

As described in the 2010 Final EIS, green sea turtles (threatened ESA status) forage in offshore waters and nest on beaches at AAFB. The majority of nesting by this species occurs in northern Guam. Historically, the Explosive Ordnance Disposal (EOD) beach at AAFB has one of highest incidents of sea turtle nesting. Nesting at AAFB by the endangered hawksbill sea turtle has not been documented.

ESA-listed threatened scalloped hammerhead sharks have only been documented in Guam's Outer Apra Harbor, which has been noted for neonate and juvenile aggregations. While scalloped hammerhead sharks may occur in the surrounding waters around Guam, they are not anticipated to be prevalent outside Guam's Outer Apra Harbor.

There is no information on NMFS species of concern specific to the waters around AAFB. However, the presence of the bumphead parrotfish is likely given the high abundance of large fish, including generally classified parrotfish. The humphead parrotfish is not expected to be found in the waters around AAFB.

Marine Conservation Areas

Three preserves and refuges are located in this region: the AAFB Marine Resource Preserve, the Pati Point Marine Preserve, and the submerged lands bordering the Guam NWR at Ritidian Point. More detailed information on these preserves and reserves is provided in Chapter 3, Affected Environment of this SEIS and in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.5: Guam Regional Environment, pages 11-44 to 11-45), but all host a variety of marine organisms and contribute to a functioning marine ecosystem with high coral cover and high overall biodiversity. Submerged lands are also discussed in Section 4.3.6.

Benthic percent cover for hard coral and macroalgae in this area were determined from NOAA Pacific Islands Fisheries Science Center Coral Reef Ecosystem Division surveys conducted from May to June of 2011. While individual marine preserves were not compared due to statistical limitations, the results show that there is substantial variability in benthic substrate among the sites surveyed with no observed difference between the marine preserve sites and the rest of the sites around Guam (Williams *et al.* 2012).

4.3.9.2 Environmental Consequences

Construction

Construction of the cantonment, family housing, and community support facilities would take place at AAFB under this alternative. There are no anticipated direct impacts to marine resources as a result of the construction of the Alternative C - potential indirect impacts on marine resources from this action are similar to those stated in the 2010 Final EIS, but of reduced intensity due to a smaller footprint with fewer people being relocated for the action proposed in this SEIS. More detailed information is available in the 2010 Final EIS, but is summarized below (Volume 2, Chapter 11: Marine Biological Resources, Section 11.2: Environmental Consequences, pages 11-78 to 11-80). Construction of facilities common to all alternatives (i.e., schools and off-site utilities) would have no impact on marine biological resources.

In addition, all marine biological resources would be affected by the utilization of the Northern District WWTP for treatment and disposal of generated wastewater for the AAFB cantonment and housing. Due to the reduced population projection and related smaller increase in demand under the 2012 Roadmap Adjustments, this increase in wastewater discharge from the Northern District WWTP would be less than under the No-Action Alternative. However, as discussed in Section 4.1.14, Utilities in this SEIS, upgrades to the Northern District WWTP are already needed for the plant to achieve compliance with the treatment standards required by its current NPDES permit. Increasing the wastewater discharge from a non-compliant treatment plant would be a significant indirect impact to marine biological resources during the period of non-compliance.

Impacts to water quality for marine biological resources resulting from changes in WWTP wastewater flows are discussed here and are not included in the analysis for each subcategory of marine biological resources below, which are limited to stormwater, sedimentation, and other non-point source pollution and recreational impacts.

The measures used to minimize these potential impacts include appropriate resource agency specific BMPs, construction and industrial permit BMPs, LID features in accordance with the DoD UFC LID (UFC 3-210-10) and Section 438 of the EISA, USACE permit conditions, and general marine resources protective measures, are described in the 2010 Final EIS (Volume 7 and Volume 2, Chapter 11: Marine Biological Resources, Section 11.2: Environmental Consequences, pages 11-70 to 11-71) and summarized in Chapter 2 of this SEIS. Specifically, the site-specific SWPPP within the Construction General Permit would identify appropriate BMPs for the site that would serve to contain runoff and

sediment on-site by reducing the flowrate of runoff and thereby minimize suspension of sediment and promote infiltration of runoff.

Marine Flora and Invertebrates

The construction of the cantonment and housing at AAFB would not directly impact marine flora and invertebrates. These resources would not be impacted directly by the proposed action because there are no in-water or land-based construction, dredging, or training activities associated with the proposed cantonment and housing construction at AAFB that would impact the marine environment.

Indirect impacts to the coral reef ecosystem located near the project area may occur from increased use of this resource by construction workers. The magnitude of impacts is directly related to the increase in recreational use. However, contract construction personnel would be issued base passes for official business only and these restrictions would be specified in construction contracts.

The DON plans to educate construction workers via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities around Guam. Indirect short-term impacts to marine flora and invertebrates may still occur from increased nearshore activities in the area by construction workers.

With implementation of access restrictions and environmental education and outreach for the construction workforce, there would be no direct impacts and less than significant indirect short-term impacts to marine flora and invertebrates.

Fish

There would be no direct impacts and less than significant indirect impacts on fish as a result of construction for the proposed action. Impacts to fish stocks around the project area may occur from increased use of this resource by construction workers. However, contract construction personnel would be issued base passes for official business only and these restrictions would be specified in construction contracts. Potential impacts would occur after work hours or on weekends and would be short-term and localized, and would therefore be minimal.

AAFB's INRMP also prohibits hook and line fishing at designated locations and includes designated swimming and snorkeling locations, thereby decreasing the potential for indirect impacts. These designations are likely to be continued in the JRM INRMP (JRM 2013). Any increased recreational activity would also be spread among the beaches surrounding AAFB (e.g., Tarague Beach), both DoD and non-DoD.

The DON plans to educate construction workers via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities around Guam.

With implementation of access restrictions and environmental education and outreach for the construction workforce, there would be no direct impacts and less than significant indirect short-term impacts to fish.

Essential Fish Habitat

The construction of the cantonment and housing at AAFB would result in no direct impacts and less than significant indirect impacts to EFH for reasons consistent with those given above for marine flora and invertebrates. There would be no impacts to EFH from stormwater, sedimentation, or other non-point

source pollution from construction projects due to compliance with the Construction General Permit and the implementation of appropriate construction BMPs.

Per the Magnuson-Stevens Fishery Conservation and Management Act, there would be no adverse effect on EFH because construction of the proposed action would not reduce the quality or quantity of EFH with implementation of access restrictions, environmental education and outreach for the construction workforce, and the Construction General Permit and appropriate construction BMPs.

Special-Status Species

There would be no direct impacts and less than significant indirect impacts on special-status species as a result of the proposed action with the compliance with the Construction General Permit, implementation of appropriate construction BMPs, and access limitations for construction workers, as described for the resources above.

In-water green sea turtles may be disturbed by increased activity in the area but potential impacts would be short-term and minimal with sea turtle-specific BMPs implemented (e.g., scheduling of construction activities around sea turtle nesting season and choice of any construction-related lighting near beach areas). Therefore, there would be less than significant impacts to the green sea turtle.

Marine Conservation Areas

Conservation efforts and management activities at the AAFB Marine Resource Preserve, the Pati Point Marine Preserve, and the submerged lands bordering the Guam NWR at Ritidian Point are not expected to be significantly impacted, directly or indirectly, as a result of the construction of the proposed cantonment and housing at AAFB. Less than significant impacts on these marine preserves and reserves may result from increased, but temporary and limited, recreational impacts as previously described in the resource sections above.

Operation

Potential operational effects of the proposed AAFB cantonment and housing are described in detail in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.2: Environmental Consequences, page 11-74 to 11-78) and summarized for reference below. Potential impacts for the operation of the proposed AAFB cantonment and housing are reduced from those evaluated in the 2010 Final EIS for the previously proposed cantonment and housing action. Operation of facilities common to all alternatives (i.e., schools and off-site utilities) would have no impact on marine biological resources.

Marine biological resources would be impacted by the increased wastewater discharge from the Northern District WWTP for treatment and disposal of generated wastewater during the operation of cantonment/family housing at AAFB. The associated potential impacts would be similar to those described earlier in this section for construction-related impacts. However, upgrades to bring the Northern District WWTP into compliance with the permit are expected to be completed early in the operational phase of the proposed action and such upgrades would mitigate the impact to a less than significant level. Refer to construction impacts above for a detailed discussion of WWTP discharge impacts.

Mitigation to address this impact would be the same for Alternative C as described for Alternative A in Section 4.1.9.2. With such mitigation, the impact to marine biological resources via water quality would be beneficial in the long-term because wastewater discharge from the Northern District WWTP would improve over existing conditions with treatment upgrades. However, if increased wastewater flows occur as a result of the relocation before upgrades are made, there would be short-term, significant impacts to marine biological resources via water quality until upgrades are completed. Impacts to water quality for

marine biological resources resulting from changes in WWTP wastewater flows are discussed here and are not included in the analysis for each subcategory of marine biological resources below, which are limited to stormwater, sedimentation, and other non-point source pollution and recreational impacts.

Marine Flora and Invertebrates

The operation of the cantonment and housing at AAFB would not directly impact marine flora and invertebrates. The DON plans to educate its service members and their dependents via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities, particularly since the proposed cantonment and housing are close to the ocean and nearby beaches, potentially leading to increased recreational use of marine biological resources in the immediate area. The Environmental Compliance Assessment, Training and Tracking System program is one possibility for such an educational training program to minimize these potential increased recreational impacts to marine flora and invertebrates.

Implementation and enforcement of appropriate BMPs (provided in Chapter 2) and protective measures would avoid and minimize potential long-term, indirect impacts to marine flora and invertebrates. For example LID measures would include vegetated swales for conveyance and detention/retention ponds capable of capturing, storing, and treating additional runoff from the 25-year design storm. For each basin, water quality treatment strategies were selected based on the effectiveness of BMPs to treat identified pollutants of concern from proposed land uses within that basin. Implementation of LID would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event.

With implementation of environmental education and outreach for service members and their dependents and appropriate BMPs, there would be no direct impacts and less than significant indirect short-term impacts to marine flora and invertebrates.

Fish

There would be no direct impacts to fish as a result of the operation of the cantonment and housing at AAFB. Indirect impacts to fish stocks around the project area may occur from increased use of this resource by DoD personnel and their dependents living and working at AAFB. The magnitude of impacts is directly related to the increase in recreational use.

Impacts to fish stock and EFH around the project area may occur from increased use of this resource by operation-related DoD personnel and their dependents living and working at AAFB. The magnitude of impacts is directly related to the increase in recreational use. However, the potential long-term, indirect impacts on the local fish stocks as a result of the proposed increase in military population and dependents at AAFB are expected to be less than significant primarily because past studies have shown that military personnel do not play a large role in recreational fishing. Instead, military personnel tend to use charter services which make up only 7% of the fleet. Local residents do most of the recreational fishing in the area, with tourists, military personnel, and residents associated with the military accounting for a smaller proportion of recreational fishing activity (Allen and Bartram 2008). Current levels of recreational fishing are well below the historic highs of the 1990s. There has been no evidence of overfishing in the waters around AAFB and the military relocation to Guam is not likely to substantially contribute to any existing pressures on the resource.

AAFB's INRMP also prohibits hook and line fishing at designated locations and includes designated swimming and snorkeling locations, thereby decreasing the potential for indirect impacts. These designations are likely to be continued in the JRM INRMP (JRM 2013). Any increased recreational activity would also be spread among the beaches surrounding AAFB (e.g., Tarague Beach), both DoD and non-DoD.

The DON plans to educate its service members and their dependents via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities, particularly since the proposed cantonment and housing are close to the ocean and nearby beaches, potentially leading to increased recreational use of marine biological resources in the immediate area. The Environmental Compliance Assessment, Training and Tracking System program is one possibility for such an educational training program to minimize these potential increased recreational impacts to fish.

There would be no impacts on fish from stormwater, sedimentation, or other non-point source pollution from operational activities due to the implementation and enforcement of appropriate LID measures and BMPs.

With implementation of environmental education and outreach for service members and their dependents, fishing restrictions as determined by the JRM INRMP, and appropriate BMPs, there would be no direct impacts and less than significant indirect short-term impacts to fish.

Essential Fish Habitat

The operation of the cantonment and housing at AAFB would result in no direct impacts and less than significant indirect impacts to EFH for reasons consistent with those given above for marine flora and invertebrates. With implementation of INRMP fishing restrictions, environmental education and outreach for DON service members and their dependents, and operation and maintenance of LID measures and BMPs, there would be no direct impacts and less than significant indirect short-term impacts to EFH as a result of stormwater, sedimentation, and other non-point source pollution and recreational impacts.

However, as described in Section 4.1.9.2 for Alternative A, the Northern District WWTP is out of compliance with its permit issued by USEPA in April 2013 and increasing the wastewater discharge from a non-compliant treatment plant would result in significant indirect impacts to marine biological resources during the period of non-compliance. Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate this significant impact to marine biological resources. These impacts and the associated mitigation would be the same for Alternative C as described for Alternative A in Section 4.1.9.2.

Special-Status Species

There would be no direct impacts and less than significant indirect impacts on special-status species as a result of operation of the cantonment and housing at AAFB. There would be no impacts on special-status species from stormwater, sedimentation, or other non-point source pollution from operational activities due to the implementation of appropriate LID measures and BMPs.

Conservation efforts implemented by the DON may provide additional protection to all coral, including those being considered for ESA-listing, and sea turtles in adjacent areas mostly frequented by people abiding by the JRM INRMP. Additional information may need to be included in these conservation

efforts once final determinations are made regarding the potential listing of coral species offshore at AAFB. However, regardless of listing status, impacts are expected to be less than significant.

Increased dive boat operations have the potential for increased turtle harassment and strikes. However, because of the mobility of sea turtles combined with the protective measures anticipated to be in place (i.e., by dive boat operators and the DON), such increased recreational activities may result in less than significant impacts to sea turtles. While green sea turtles may be disturbed by increased activity in the area, potential impacts would be short-term and minimal with sea turtle specific BMPs implemented (i.e., lighting near ocean, noise). Any such impacts to the sea turtle population would be reduced in intensity from the previously proposed action evaluated in the 2010 Final EIS.

Marine Conservation Areas

Conservation efforts and management activities at the AAFB Marine Resource Preserve, the Pati Point Marine Preserve, and the submerged lands bordering the Guam NWR at Ritidian Point are not expected to be significantly impacted, directly or indirectly, as a result of the operation of the proposed cantonment and housing at AAFB. It is anticipated that the popular snorkeling and dive sites may experience increased recreational activity, but protective measures would minimize these long-term, indirect impacts to less than significant for these marine preserves, for the reasons previously described in the resource sections above.

4.3.10 Cultural Resources

4.3.10.1 Affected Environment

The following discussion summarizes previous cultural resources studies and known historic properties and other cultural resources within the area of potential cultural resource impacts associated with Alternative C. The discussion below addresses historic properties, as defined in the NHPA, and resources of cultural importance as defined under NEPA. The discussion refers to the terms *direct effects* and *indirect effects* to historic properties as defined under the NHPA, and impacts to other cultural resources as defined under NEPA (see Section 3.10.3.2). The section is organized to address cultural resources for the cantonment/family housing, followed by discussion of the same resource types for off-site utilities and school expansions associated with this alternative. If this alternative is selected for implementation, the information presented here would be augmented by reviews consistent with the 2011 PA, which provides overall NHPA Section 106 compliance and addresses other cultural resource issues. Refer to Section 3.10 for a detailed description of the 2011 PA. Additionally, some built properties in this section are covered by *Program Comments* executed by the ACHP, which resolve Section 106 responsibilities for certain DoD facilities. See Chapter 3, Section 3.10 for more information on definitions and procedures.

AAFB is located on the northern plateau area of Guam. It includes the main active airfield and an array of operations, maintenance, and community support facilities. The central third of the installation is a MSA. The western third is NWF, a WWII-era airfield used for fixed-wing aircraft and helicopter training and various field exercises and bivouacs. Alternative C would construct and operate administrative and housing areas, community support facilities (e.g., schools, child development center, community center), and associated utilities (see Figure 2.4-8 in Chapter 2 of this SEIS).

The affected environment for cultural resources associated with Alternative C is generally consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 12: Cultural Resources, Section 12.1.2.1: Andersen AFB, pages 12-9 to 12-16), which were based on surveys of PDIAs completed at that time. This description of the affected environment provided here has been updated with new information from recent archaeological and architectural investigations supporting this SEIS and other projects. To determine whether information is from an existing reference (such as the 2010 Final EIS or other cultural resource studies) or collected during in-fill studies conducted in support of this SEIS, refer to dates in the reference column in each table for the archaeological sites. Information for the architectural resources was derived from iNFADS.

Surveys conducted to support the 2010 Final EIS included the PDIA for Alternative C. Those previous investigations included intensive archaeological surveys (Athens 2009; Welch 2010), architectural inventories (Welch 2010; SEARCH 2013), and potential TCP studies (Griffin *et al.* 2010). In addition to these surveys and other past surveys (Grant *et al.* 2007), an intensive archaeological survey of 993 acres (402 ha) and an architectural inventory was conducted for this SEIS (Dixon *et al.* 2014). These investigations provide a comprehensive inventory of cultural resources and TCPs occurring within the PDIA associated with Alternative C.

In addition to the primary cantonment/family housing areas, on-site utility corridors associated with Alternative C would be located near the southern boundary of AAFB (see Figure 2.4-9). Intensive archaeological surveys of portions of the utility line PDIA on AAFB were conducted in 2007 (Welch 2010), 2010 (Dixon and Walker 2011), and 2013 (Dixon *et al.* 2014).

All cantonment alternatives would include construction of off-site utilities along Routes 1, 3, and 9, a water well field at AAFB, and expansion or construction of two schools at Naval Base Guam and AAFB (see Figure 2.4-14). Assessments of potential impacts to cultural resources from construction of utilities along road right-of-ways are based on a reconnaissance survey of portions of the area in 2010 (Dixon *et al.* 2011b) and a literature review of previous surveys and historic development in the area. Assessments of potential impacts to cultural resources from the development of a water well field and from the two school expansions are based on the in-fill surveys in support of this SEIS (Dixon *et al.* 2014).

Based on data from previous surveys of the proposed cantonment/family housing area, and utility corridor impacted areas, Table 4.3.10-1 lists the 54 known archaeological sites located within the Alternative C PDIA on AAFB. Four sites are considered eligible for listing in the NRHP; these are all Pre-Contact/Latte Period artifact scatters. Fifty of the sites are not considered eligible for listing in the NRHP and are shallow, disturbed, low density pottery scatters, portions of WWII-era concrete pads, or WWII to Cold War-era bottle scatters.

Table 4.3.10-1. Archaeological Sites within the AAFB Cantonment/Family Housing Alternative PDIA

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-07-2109	991	Sherd scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2110	992	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2111	993	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2112	994	Sherd scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2120	1002*	Sherd scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2125	1007*	Sherd scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2126	1008*	Sherd scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2319	T-9/1044	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2320	T-10/1045	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-07-2321	T-11/1046	Ceramic/artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-07-2322	T-14/1049	Ceramic/artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-07-2323	T-NW-1/1050	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-07-2573	T-AN-001	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-07-2574	T-AN-002	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-08-2575***	T-AN-003	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2576***	T-AN-004	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2577***	T-AN-005	Concrete foundations	Post-WWII/ /Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2578***	T-AN-006	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2579***	T-AN-007	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2580	T-AN-008	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-08-2581	T-AN-009	Concrete foundations	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2582***	T-AN-010	Aircraft remains	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2583***	T-AN-011	Defensive position	WWII/Japanese Military Occupation	Dixon *et al.* 2014	No	NA
66-08-2584	T-AN-012	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-08-2585***	T-AN-013	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2586	T-AN-014	Concrete foundation	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
	T-AN-015	Concrete foundations	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2587***	T-AN-016	Elevated concrete foundation	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2588***	T-AN-017	Concrete footings	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2589	T-AN-018	Concrete foundation	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA

Table 4.3.10-1. Archaeological Sites within the AAFB Cantonment/Family Housing Alternative PDIA

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-2590	T-AN-019	Concrete foundation	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2591	T-AN-020	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2592	T-AN-021	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
	T-AN-022***	Concrete foundations	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2593***	T-AN-023	Concrete foundation	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2594***	T-AN-024	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2595	T-AN-025	Defensive position	WWII/Japanese Military Occupation	Dixon *et al.* 2014	No	NA
66-08-2596***	T-AN-026	Septic tank structures	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2597***	T-AN-027	Concrete foundation	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2598	T-AN-028	Defensive position	WWII/Japanese Military Occupation	Dixon *et al.* 2014	No	NA
66-08-2599	T-AN-029	Concrete foundation	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2600	T-AN-030	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2601***	T-AN-031	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2602***	T-AN-032	Concrete foundation	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2603***	T-AN-033	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
	T-AN-034	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2605***	T-AN-035	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2606	T-AN-036	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2607	T-AN-037	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-08-2608	T-AN-038	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-08-2609***	T-AN-039	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-08-2610	T-AN-040	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
66-08-2611	T-AN-041	Defensive position	WWII/Japanese Military Occupation	Dixon *et al.* 2014	No	NA

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.
*Map numbers are from Welch (2010).
** Revised to match Guam GHPI forms dated May 28, 2014.
***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated August 22, 2013 and September 17, 2014 [RC2013-0853]).

As the on-site utility corridors are contained within the well development area, sites are discussed in that paragraph below. No TCPs have been identified in the PDIA for this alternative. However, culturally important natural resources may be located in the vicinity of the PDIA.

There are 832 architectural properties, constructed between 1944 and 2009, within the PDIA for the Alternative C (Table 4.3.10-2). These buildings and structures include historic North Field, housing, barracks, administrative facilities, and recreational facilities. North Field, a gatehouse, and a firehouse are considered eligible for listing in the NRHP. Six buildings and structures in the PDIA are administrative or support facilities (e.g., maintenance facilities and utilities) that are greater than 50 years in age that have not been evaluated. If this alternative is selected, then unevaluated properties would be evaluated under the procedures identified in the 2011 PA. A total of 766 buildings are covered under the *Program Comment for Wherry and Capehart Era Family Housing at Air Force and Navy Bases* (ACHP 2004). Two buildings are bachelor housing covered under the *Program Comment for Cold War Era Unaccompanied Personnel Housing* (ACHP 2006; see Chapter 3.10.3 for more information on Program Comments). Fifty-five buildings and structures are less than 50 years old and do not meet the exceptional significance threshold required under NRHP Criteria Consideration G. The 2011 PA includes procedures for the identification of historic properties, as specific projects are developed, through consultation with the Guam SHPO and the public.

Table 4.3.10-2. Summary of Architectural Properties Located within the AAFB Cantonment/Family Housing Alternative Potential Impacted Area

Building/Structure Type	*Location*	*Number of Buildings/Structures of this Type in Impacted Area*	*Date of Construction*	*NRHP Eligible?*
North Field (GHPI number 66-07-1064)	AAFB	1	1944	Yes
Administration or Support	AAFB	3	1954 to 1964	Not Evaluated
Family Housing	AAFB	766	1956 to 1963	Covered under Program Comment
Unaccompanied Personnel Housing (barracks)	AAFB	2	1956	Covered under Program Comment
Support Facilities				
Sewer Lift Station	AAFB	1	1960	Not Evaluated
Well AF-1	AAFB	1	Unknown	Not Evaluated
Gatehouse	AAFB	1	1964	Yes
Firehouse	AAFB	1	1955	Yes
Maintenance, support, recreation, and supply facilities	AAFB	37	1963 to 2008	No
Pavilions/Bus Shelters	AAFB	13	1987 to 1993	No
Billboards, Signs, Marquees	AAFB	5	2006 to 2009	No
Overwatch	AAFB	1	Unknown	Not Evaluated

Note: Information on type, number, and date of construction from iNFADS.

In addition to the cantonment/family housing, and utility corridor areas, Alternative C would include construction of off-site utilities, a water well field, and expansion or construction of two schools. Nine NRHP-eligible archaeological sites and 15 sites not considered eligible for listing in the NRHP have been identified in these areas (see Alternative A, Table 4.1.10-4 and 4.1.10-5). As under Alternative A, 1 structure within the well development area on AAFB is eligible for listing in the NRHP, 4 structures are not eligible, and 6 structures are unevaluated. (No architectural properties or TCPs have been identified within the off-site utilities potential impacted area.

Under Alternative C, the Andersen Middle School facility would be repurposed as an elementary school and expanded at its current site, and a new middle school would be constructed. This area is within the AAFB cantonment/family housing potential direct impacted area. The expansion of the DoDEA High School would involve construction at the Naval Hospital site in central Guam. No NRHP-eligible sites, architectural properties, or TCPs have been recorded in this area.

4.3.10.2 Environmental Consequences

Construction

Construction activities associated with Alternative C may adversely affect historic properties. Final determinations of effect would occur under the 2011 PA. Following is a discussion of potential adverse effects for purposes of this analysis. Excavation and soil removal associated with buildings and on-site utility construction could adversely affect four known NRHP-eligible archaeological sites, including Pre-Contact/Late Period artifact scatters (see Table 4.3.10-1). Excavation and soil removal could also adversely affect one historic structure, North Field.

Construction at AAFB would also require the demolition of 832 buildings (Table 4.3.10-3). Of these 832 buildings and structures, two are considered eligible for listing in the NRHP, two buildings are covered under the *Program Comment for Cold War Era Unaccompanied Personnel Housing* (ACHP 2006), and 766 are covered under the *Program Comment for Wherry and Capehart Era Family Housing at Air Force and Navy Bases* (ACHP 2004). Fifty-five buildings and structures are not eligible, and six are unevaluated. The Program Comments resolve NHPA Section 106 requirements for demolition of these 768 buildings. As 55 buildings and structures are not eligible for listing in the NRHP, the demolition of these buildings under Alternative C would be consistent with a finding of no historic properties affected. Consistent with the 2011 PA, final determinations of eligibility, including the six unevaluated properties, an assessment of effect would be completed in conjunction with project-specific reviews, if this alternative is selected.

Table 4.3.10-3. Architectural Properties to be Demolished within the AAFB Cantonment/Family Housing Alternative PDIA

Building Name or Type	*Location*	*Facility Number(s)*	*Date of Construction*	*NRHP Eligible?*
Administration or Support	AAFB	2403,9000, 9002	1954 to 1964	Not Evaluated
Family Housing	AAFB	1000-1050, 1052, 1054-1085, 1100--1151, 1153-1187, 1200--1292, 1300--1368, 1400-1483, 1500--1571, 1700---1765, 1800--1872, 1900-1974, 2000--2062	1956 to 1963	Covered under Program Comment
Unaccompanied Personnel Housing (barracks)	AAFB	1051, 1053	1956	Covered under Program Comment

Table 4.3.10-3. Architectural Properties to be Demolished within the AAFB Cantonment/Family Housing Alternative PDIA

Building Name or Type	*Location*	*Facility Number(s)*	*Date of Construction*	*NRHP Eligible?*
Support Facilities				
Sewer Lift Station	AAFB	1295	1960	Not Evaluated
Well AF-1	AAFB	9007	Unknown	Not Evaluated
Gatehouse	AAFB	2505	1964	Yes
Firehouse	AAFB	9001	1955	Yes
Maintenance, support, recreation, and supply facilities	AAFB	1294, 1599, 1605, 1621, 1622, 1623, 1624, 1625, 1627, 1637, 1638, 1639, 1640, 1641, 1655, 1656, 1782, 1786, 1879, 1881, 1882, 2401, 2508, 2544, 2550, 9003, 9004, 9006, 9100, 9101, 9103, 9104, 9105, 9106, 9122, 22029, 26101	1963 to 2008	No
Pavilions/Bus Shelter	AAFB	1087, 1383, 1630, 1660, 80140, 80141, 80142, 80143, 81955, 81956, 81957, 81958, 81959	1987 to 1993	No
Billboards, Signs, Marquees		1598, 1626, 26108, 26999, 24020	2006 to 2009	No
Overwatch	AAFB	Unknown	Unknown	Not Evaluated

Excavation and soil removal associated with the construction of off-site utilities could adversely affect 9 known NRHP-eligible archaeological sites (see Alternative A, Tables 4.1.10-4 and 4.1.10-5) and 1 NRHP-eligible structure. Six structures that are unevaluated could also be affected by construction.

In addition, construction at AAFB has the potential to directly impact culturally important resources that are not historic properties, but may be considered under NEPA. The project would require the removal of limestone forest where culturally important natural resources may be present. The 2011 PA contains measures for coordinating with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans regarding identification and disposition of these important resources (see 2010 Final EIS, Volume 2: page 2-10; Volume 9, Appendix G, Chapter 4).

Operation

Operations associated with Alternative C would not directly affect any historic properties or impact natural resources of cultural importance. Indirect adverse effects to known NRHP-eligible archaeological sites would be minimal due to an increase in population as these sites are not adjacent to the cantonment area.

Summary of Impacts and Potential Mitigation Measures

Implementation of Alternative C could cause direct, adverse effects to 13 known NRHP-eligible sites and four historic structures, which is fewer than Alternatives A and B, but more than Alternative D. Refer to Section 4.7, Table 4.7-1 for a comparison of cultural resources impacts and potential mitigation measures for each cantonment/family housing alternative. Demolition could also affect 12 buildings and structures that have not been evaluated for listing in the NRHP (see Tables 4.1.10-5 and 4.3.10-3).

Direct impacts could occur to natural resources of cultural importance as a result of removal of limestone forest and traditional plants. The 2011 PA includes measures to coordinate with SHPO and concurring parties to address appropriate treatment of these resources.

The 2011 PA, as discussed in Section 3.10.2., establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. Broadly, the 2011 PA includes processes to share information, consider views of the public, and develop mitigation measures when historic properties may be adversely affected. The 2011 PA provides measures for mitigating adverse effects to NRHP-eligible or listed archaeological sites, consulting on new projects and initiating additional identification efforts, and resolving impacts due to loss of access to culturally important natural resources. To the degree possible, direct and indirect impacts to historic properties and other resources of cultural importance would be avoided or minimized during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, Table 4.3.10-4 presents potential mitigation measures to resolve adverse effects to historic properties and reduce impacts to cultural resources resulting from the implementation of Alternative C. With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that significant direct and indirect impacts due to construction, as defined under NEPA, would be reduced to a level below significance.

Table 4.3.10-4. Potential Mitigation Measures for Alternative C for Adverse Effects (NHPA) and Impacts to Other Cultural Resources (NEPA)

NHPA Effects	***Mitigation***
Potential direct adverse effects to 17 historic properties - 13 NRHP-eligible archaeological sites and NRHP-eligible structures)	Consistent with the 2011 PA, data recovery is the standard mitigation for historic properties that are strictly archaeological in nature. Accordingly, the DON will submit a mitigation plan to the SHPO, consult with other PA Signatories and Concurring Parties if requested, and submit data recovery reports for SHPO review prior to finalizing mitigation reports. Mitigation also includes preparation of public education and interpretation materials in English and Chamorro using the information developed or data recovered to create a summary of the work completed and a statement regarding the mitigated site's significance to the regional culture. Additional mitigation would include enforcement of construction contract stipulations and GHPI data form updates as required by the 2011 PA.
Undetermined effects to 12 unevaluated buildings	If this alternative is selected in the ROD, unevaluated properties that may be affected would be evaluated consistent with the 2011 PA. If determined eligible for listing in the NRHP, appropriate mitigation measures would be developed to resolve any adverse effects.
NEPA Impacts	***Mitigation***
Potential direct impacts to culturally important natural resources	Through the 2011 PA process, coordinate with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans to provide an opportunity to collect these resources consistent with installation security instructions and safety guidelines.

4.3.11 Visual Resources

4.3.11.1 Affected Environment

A list and description of visual resources at AAFB is contained in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.1: Affected Environment, pages 13-1 to 13-8). AAFB is composed of runways, buildings, facilities, and housing areas all surrounded by moderately to heavily vegetated forest. Due to the relatively flat topography and moderate to heavy vegetation, the surrounding communities of Dededo and Yigo have limited views into AAFB. One exception to this is the views afforded from Mount Santa Rosa (Photos 4.3.11-1 and 4.3-11-2). From this point, sweeping 360-degree views can be seen of the entire north area, including distant views of AAFB facilities and surrounding landscape.



Photo 4.3.11-1. View from Mount Santa Rosa
Source: Goatlockerguns 2008a



Photo 4.3.11-2. View of AAFB from Mount Santa Rosa
Source: Goatlockerguns 2008b

4.3.11.2 Environmental Consequences

Construction

Construction activities and equipment may temporarily block views as seen from viewing areas. The disruption would cease once the cantonment and family housing are built. Therefore, there would be minor short-term direct impacts on visual resources. These impacts would be less than significant.

Operation

Unlike development proposed at Finegayan, the proposed development at AAFB differs substantially from that proposed and approved under the 2010 Final EIS. The 2010 Final EIS analyzed the construction of the Air Combat Element at the North Ramp, construction of air embarkation facilities at South Ramp, and construction of the North Gate and access road. In contrast, this SEIS analyzes a cantonment/family housing development at AAFB. Currently, as seen from a viewing area such as Mount Santa Rosa, the urban development at AAFB is sparse due to its rural location, and the base is somewhat blended in with surrounding vegetation and the coastline in the background. The resulting appearance, which would include more urban development related to the cantonment/family housing, would be less than significantly altered due to the continuing dominant presence of vegetation throughout the region. Consequently, less than significant long-term direct impacts on visual resources would result from implementation of this alternative.

4.3.12 Ground Transportation

4.3.12.1 Affected Environment

The affected environment for ground transportation resources under Alternative C includes transportation facilities internal to the site (on-base roadways and intersections) and entry control facilities. This section discusses existing conditions and assesses how the construction and operations of Alternative C would potentially affect conditions for roadways, transit facilities, and pedestrian and bicycle facilities on-base. Potential ground transportation impacts to off-base (external) roadways are addressed in Section 6.1 of this SEIS.

Roadway Network

AAFB has two existing access gates. The Main Gate provides access between Route 1 and Arc Light Boulevard. Arc Light Boulevard is the main roadway on-base and provides an east/west route across the base. The Santa Rosa Gate is located approximately 1.1 mile (1.8 km) southeast of the Main Gate and provides access between Route 15 and Santa Rosa Boulevard. Santa Rosa Boulevard passes through housing areas on-base. All of the base roadways are two lanes (one lane in each direction), with additional separate turning lanes at major intersections. All of the on-base intersections are currently controlled by two- or all-way stop signs.

The AAFB Traffic and Safety Engineering Study (AAFB 2009) concluded that most of the on-base intersections were operating at acceptable LOS (LOS A, B, C, D, or E), with the exception of several intersections along Arc Light Boulevard. The study recommended improvements for those intersections.

Transit Network

There is no existing transit service on AAFB. The GRTA operates fixed route and paratransit service. The Blueline 1, servicing Hagåtña, Tamuning, Micronesia Mall, and Tumon, is the nearest fixed route bus line, and operates at a distance of approximately 10.5 miles (16.9 km) from AAFB. Paratransit service is provided to all ADA-eligible certified passengers, by provided transportation to the nearest fixed route.

Pedestrian and Bicycle Network

There is a dedicated pedestrian jogging trail provided along Arc Light Park and Bonins Avenue. No other dedicated pedestrian or bicycle facilities exist on or near AAFB. Typically, the outside lane or shoulder, which is generally unpaved, functions as the pedestrian/bicycle space.

4.3.12.2 Environmental Consequences

Potential ground transportation impacts addressed in this section are limited to elements of the proposed action that could affect on-base (internal) roadways. Potential ground transportation impacts to off-base (external) roadways are addressed in Section 6.1 of this SEIS.

Construction

Potential short-term, direct construction impacts generated by the proposed action at Alternative C would be similar to Alternative A (Section 4.1.12.2). Potential impacts to ground transportation resources from construction would be reduced to less than significant levels with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, Alternative C would result in less than significant short-term, direct impacts to on-base (internal) roadways.

Operation

Roadway Network

As currently proposed, Alternative C would have two separate, non-contiguous development areas. The cantonment would be located on the northwest end of the site and would be accessible via the new North Ramp Gate and Vehicle Inspection Facility, which is currently under construction (approximately 50% complete), as well as the existing AAFB Main Gate on Route 9. The family housing area (and the 912 Air Force housing units that would be redeveloped on the site) would be directly accessible via the existing Santa Rosa Gate on Route 15.

The proposed on-base (internal) roadway network hierarchy for Alternative C was determined based on the conceptual development plan and layout of the cantonment/family housing area, and takes into account the capacity required to accommodate the expected travel demand on the facilities. The proposed on-base (internal) roadway network hierarchy diagram for Alternative C is included in an Appendix F to this SEIS. A four-lane arterial roadway would extend from the new North Ramp Gate and Vehicle Inspection Facility to the northern extent of the cantonment, and would provide the main north/south connection. A second four-lane arterial roadway would extend from the main entry road to the east. These roadways are designed, and would be expected, to carry the heaviest traffic volumes; including civilian employee trips from off-base to/from work locations, as well as trips by military personnel to/from off-base locations. Direct internal access between the cantonment and the family housing areas would be provided via Marianas Boulevard and Carolines Avenue.

Under any of the proposed cantonment/family housing alternatives, construction of new on-base (internal) roadway facilities and entry control facilities would be required. The proposed action includes construction of on-base (internal) roadways and entry control facilities that would be implemented by the DoD. On-base (internal) roadways and entry control facilities for Alternative C, include, but are not limited to, the following:

- A new North Ramp Gate and Vehicle Inspection Facility is currently under construction and would provide direct access to the cantonment area.

- The existing AAFB Main Gate on Route 9, and the existing Santa Rosa Gate on Route 15, would provide direct access to the family housing area.
- The Santa Rosa Gate would be improved as part of the proposed action.

Two existing internal roadways on AAFB, Marianas Boulevard and Carolines Avenue, would connect the family housing area to the cantonment area. The existing roadways would be utilized to the extent possible. The proposed action includes on-base (internal) roadway construction and improvement projects that would be implemented by the DoD.

All on-base (internal) roadway segments and intersections have been designed with the capacity required to accommodate the expected travel demand. Specifically, on-base (internal) roadway segments and intersections are designed to operate at acceptable LOS (LOS A, B, C, D, or E) under future year (Year 2030) conditions with the proposed action. The proposed action would not result in significant long-term, direct impact to on-base (internal) roadways or intersections, because the proposed action would not:

- For roadway segments and intersections - cause a roadway segment or intersection operating at acceptable LOS (LOS A, B, C, D, or E) to degrade to unacceptable LOS F.
- For roadway segments - add 5% or more to the total directional peak hour volume (measured in passenger car equivalents) and result in unacceptable LOS F.
- For intersections - add 50 or more peak hour trips (measured in passenger car equivalents) and result in unacceptable LOS F.

Entry Control Facilities

The operations of the proposed entry control facilities are controlled, or dictated, by both the traffic demand and the vehicle processing speed at the security check point. The methodology and assumptions utilized to evaluate operations and potential for queuing at the entry control facilities are stated in Section 4.1.12.1.

Transit Conditions

The proposed action would not result in significant long-term, direct impact to transit, because the proposed action would not:

- Substantially increase traffic hazards to transit due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with applicable design standards.
- Fundamentally conflict with adopted policies, plans, or programs regarding public transit, or otherwise decrease the performance or safety of transit facilities.

Pedestrian and Bicycle Conditions

Bicycle and pedestrian facilities would be included in the construction of new on-base (internal) roadway facilities. Bicycle and pedestrian paths and facilities are integrated into the on-base transportation network as a means to improve mobility and safety of non-motorized traffic. The proposed bicycle and pedestrian network diagram for Alternative C is provided in an Appendix to this SEIS.

The proposed pedestrian and bicycle network includes an enhanced pedestrian sidewalk that would traverse the perimeter of the community support area near the center of the cantonment area. Multi-purpose trails would be constructed along almost all of the proposed roadways, and a jogging/biking trail network would be located primarily around the perimeter of the cantonment area. Two pedestrian overpasses; one crossing over the proposed new North Gate and Vehicle Inspection Facility, and the other

crossing over the arterial roadway north of the Santa Rosa Gate; are proposed to allow passage between the east and west portions of the cantonment and the family housing area, respectively. The family housing area would be connected to the cantonment area by a multi-purpose trail that would continue through the main corridor of the family housing area. All residential streets would be constructed with sidewalks on both sides, in addition to a jogging/biking trail located around the periphery of the family housing area.

The proposed action would not result in significant long-term, direct impact to pedestrians or bicycles, because the proposed action would not:

- Substantially increase traffic hazards to pedestrians or bicycles due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with applicable design standards.
- Fundamentally conflict with adopted policies, plans, or programs regarding bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

4.3.13 Marine Transportation

4.3.13.1 Affected Environment

The affected environment for marine transportation under Alternative C is the same as described in Section 3.1.13.1 for Alternative A.

4.3.13.2 Environmental Consequences

The environmental consequences for marine transportation under Alternative C would be the same as described in Section 4.1.13.2 for Alternative A.

4.3.14 Utilities

4.3.14.1 Affected Environment

This section includes information related to existing electrical, potable water, wastewater, solid waste, and IT/COMM utilities as they apply to the Alternative C.

Electrical Power

The existing electrical utility at the AAFB alternative includes electrical distribution systems servicing the new North Gate and family housing area. The new North Gate is currently in construction, and electrical distribution is being installed to serve this new facility. The area for the proposed cantonment is around the new North Gate and has no existing electrical power infrastructure except for that being installed for the new North Gate.

At AAFB, new power upgrades have been installed to meet the demands of future projects under development. The capacity of the substation has been substantially upgraded, and distribution lines are currently being installed and planned in order to provide power to new projects that are either under construction, or are in the design or planning stages. The newly upgraded AAFB main substation has the capacity to meet the combined present and estimated future loads, excluding the proposed action. This is in contrast to the 2010 Final EIS where it was reported that "The T&D system at Andersen AFB is currently operating near capacity…" (2010 Final EIS, Volume 6, Chapter 3: Utilities, Section 3.1 Affected Environment, page 3-5). The power being supplied to this area comes from the GPA transmission and generation system. The situation and condition of these GPA utility systems is unchanged from the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1: Affected Environment, page 3-5).

Potable Water

The DoD water transmission system in northern Guam consists of 10-inch and 12-inch asbestos cement and cast iron pipes, and is part of the DoD potable water system that conveys water between southern Guam and northern Guam. The existing potable water utility specific to Alternative C areas consists of a water distribution system serving the existing housing area. This system is in reasonably good shape having been refurbished in the 1990s (Pacific Division NAVFAC 2003). A new distribution system serving the new North Gate is currently being installed. Andersen Well No. 1 and its 8-inch feeder line, constructed in 2007, run through the proposed cantonment area. The overall AAFB potable water system remains the same as that provided in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1: Affected Environment, page 3-10) except for some major repairs performed since the 2010 Final EIS was issued. Some transmission mains have been repaired and connections to Mount Santa Rosa Storage Tank have also been repaired. Previously, the unaccounted for water for the AAFB potable water system was estimated at 50%. The DoD is committed to improving its water loss control program, and has begun to implement measures to reduce unaccounted for water, as well as to develop plans for further improvements. A recent Major Maintenance and Repair Plan water leak detection and repairs project was completed in September 2013. Water leak detection and repairs will continue for both the DON and Air Force water systems for further reduction of unaccounted for water. Based on operational experience, it is likely that unaccounted for water has decreased in the Air Force water system and is currently estimated at 35% (NAVFAC Department of Public Works, personal communication, September 2013).

The affected environment, with respect to the GWA's potable water system, is the same as described in Section 4.1.14.1 for Alternative A.

Wastewater

The GWA compliance background presented in Section 4.1.14.1 for Alternative A is the same for Alternative C.

The affected environment for wastewater utilities associated with the Alternative C remains unchanged from that described in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1: Affected Environment, pages 3-17 to 3-31), but is summarized below and is supplemented with new information.

The existing AAFB wastewater collection system consists of a network of gravity sewers totaling 38 miles (61 km), with four major WWPSs and force mains located on the south side of AAFB Main Base. The four major sewage pump stations include the Facility 1295 WWPS, the Facility 24101 WWPS, the Facility 1098 WWPS, and the Facility 1881 WWPS. The system collects wastewater generated by the industrial and residential areas on-base and discharges wastewater off-base into the GWA sewage collection system at a sewer manhole located near the AAFB Main Gate. This sewage flows through the GWA collection system along Route 9 and Route 3 to the Northern District WWTP for treatment and disposal. The existing wastewater collection system in the family housing area remains unchanged from the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1: Affected Environment, page 3-25).

The affected environment for the GWA wastewater collection system and WWTPs for Alternative C are the same as described for Alternative A in Section 4.1.14.1.

Solid Waste

The existing solid waste infrastructure specific to Alternative C consists of solid waste handling facilities at AAFB. There are no existing solid waste handling facilities within the proposed cantonment or family housing areas. However, such facilities exist elsewhere at AAFB. The existing solid waste infrastructure

both on-base at AAFB and off-base has changed since the publication of the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1: Affected Environment, pages 3-35 to 3-36). The on-base landfill is no longer used for municipal solid waste disposal since the GovGuam landfill at Layon is operational and receiving solid waste. Other waste not accepted by the Layon Landfill can be disposed of at either AAFB or Naval Base Guam Apra Harbor facilities. The DON is currently coordinating with the GEPA regarding the status of the municipal solid waste landfill permit for the Naval Base Guam Landfill. The Solid Waste Working Group consisting of DoD, GEPA and USEPA was established to coordinate and resolve landfill permitting issues, as well as other solid waste issues on Guam. The municipal solid waste area of the AAFB Landfill is in the closure process. AAFB operates a transfer station for sorting waste bound for the Layon Landfill. AAFB also continues to operate its recycling center.

Information Technology and Communications

The existing IT/COMM infrastructure at AAFB includes existing DoD and commercial telecommunication duct banks, manholes/handholes, and connection buildings. Within the area limits for the proposed cantonment, there are a few existing buried communication lines on the new access road and the new North Gate currently in construction. At the family housing area, there are existing underground commercial communication lines.

4.3.14.2 Environmental Consequences

The assessment of impacts associated with utilities assumed the implementation of sustainability strategies as described in Section 8.6, Sustainability and Smart Growth. These strategies include measures to achieve federally mandated levels of energy use reduction, water use reduction, waste reduction, and total energy from renewable sources.

Electrical Power

The existing power distribution system at AAFB is not capable of meeting increased demand from the proposed action. Thus, Alternative C includes an expanded electrical power distribution system with additional power feeds from the GPA. Based on the load projections for both the cantonment and family housing, no upgrade would be required to the GPA's generating capacity, since the total load increase would be within the capacity of their generating plants. However, upgrades to existing 34.5 kV transmission power lines would be required to stay within operating parameters. The electrical power distribution system for Alternative C as described in Section 2.4.4.3 includes extending 34.5 kV transmission power lines to a new switching station at the North Ramp. The installation of the switching station is not part of the proposed action. Additionally, for this alternative, a dedicated substation would be required to provide power to the main cantonment. This plan has been developed to handle all system demands currently in existence for areas served by the current local power distribution system, in addition to the increased demand from the proposed action. Thus, there would be no adverse actions for the current power customers aside from potentially short-term power outages during construction of the expanded system. Power outages would be mitigated through construction phasing, with the use of temporary generators, and/or temporary connections to alternative power sources where necessary, which would minimize downtime.

The island-wide impacts to the GPA's system would be the same as for Alternative A, as described in section 4.1.14.2.

These direct impacts to the power system are deemed less than significant, both during construction and in operation.

Potable Water

There is currently no potable water distribution system at the area for the cantonment. However, a potable water distribution system is being installed for the new North Gate. There is an existing potable water distribution system serving the area proposed for family housing redevelopment that would need to be restructured during the housing area redevelopment proposed in Alternative C. The proposed potable water distribution system for Alternative C as described in Section 2.4.4.3 has been developed to handle all system demands currently in existence for areas served by the current DoD water distribution system, in addition to the increased demand from the proposed action. During construction, service would be maintained to current DoD customers via construction phasing, temporary lines, or other actions. Thus, there would be no adverse impacts for the current DoD water customers aside from potentially brief water outages during construction of the expanded and modified systems. With careful planning, these potential outages would be minimized.

DoD Potable Water System

The direct impacts to the DoD potable water system would be the same for Alternative C as for Alternative A, as described in Section 4.1.14.2. Impacts to the DoD potable water system with the implementation of Alternative C are deemed less than significant, since the improvements would provide adequate potable water to the proposed action facilities.

GWA Potable Water System

Potential impacts to the GWA system would be the same for Alternative C as for Alternative A, as described in Section 4.1.14.2. Thus, the short- and long-term impact to the GWA's distribution system from the proposed action is expected to be less than significant, due to the small increase in demand from the indirect impacts of the proposed action.

NGLA Water Extraction

Potential short- and long-term impacts to the NGLA, and potential mitigation measures of impacts would be the same for Alternative C as for Alternative A, as described in Section 4.1.14.2. Thus, the localized direct impact to the NGLA is considered significant, but the impact to the overall NGLA is less than significant. Potential mitigation measures for Alternative C are the same as for Alternative A in Section 4.1.14.2.

Wastewater

The impacts and mitigations associated with wastewater for Alternative C would be the same as for Alternative A, as described in Section 4.1.14.2.

Solid Waste

The environmental consequences for the solid waste infrastructure under Alternative C are generally limited to planned construction of a solid waste transfer station and recycling facility as described in Section 2.4.4.3. Since new facilities serving the proposed cantonment area would be provided, the existing solid waste capabilities at AAFB would not be impacted, and there would be no environmental impact to solid waste handling at AAFB. The increased demand to the overall solid waste handling capability would be gradually spaced over the 10 or more years projected (over the primary duration of the proposed action), and the roughly 7,000 additional people (Marines active duty, dependents, and DoD civilian workers) that would arrive on Guam and use the proposed Marine Corps facilities. The long-term increase in solid waste generated by the increased Marine Corps population at the AAFB cantonment area

would be managed by the new transfer station, recycling center, and additional solid waste handling trucks/equipment planned. Because of the limited capacity of the solid waste facilities at AAFB, new facilities would be provided.

C&D debris generated during construction would be handled by the U&SI contractor at the designated laydown area near the proposed cantonment site. The DON updated the Final Comprehensive Construction and Demolition and Solid Waste Management Plan for Guam Military Relocation, including the green waste management sections. The Utilities and Site Improvement (U&SI) contractor would be required to process/compost green waste on-site. As part of construction waste management, contractors would be required to submit a green waste processing/composting plan to Navy and obtain required solid waste permits for green waste processing and composting from GEPA. The DON will review the contractors' project-specific waste management plans prior to their submittal to GEPA and will provide oversight during the construction. The U&SI contractor would be required to divert a minimum of 60% of the C&D debris and all of the green waste from landfill disposal. The larger-sized green waste consisting of trees and stumps would be processed into mulch, and the smaller-sized green waste would be processed into compost. The C&D debris would consist mainly of concrete rubble resulting from the demolition of existing AAFB housing units during the U&SI phase. This concrete rubble would be crushed and used as lower graded aggregate. The C&D waste not diverted would be transported to a permitted facility.

The DON proposes to explore ways to resolve key solid waste issues, specifically the status of the Naval Base Guam Landfill permit and handling of special wastes not accepted at Layon Landfill, through the Solid Waste Working Group that was established with USEPA and GEPA on July 24, 2014. During the September 19, 2014 meeting of the Solid Waste Working Group, GEPA indicated that they will formally respond to DON correspondence with regards to issues relative to the Naval Base Guam Landfill. The Layon Landfill and the permitted private hardfill facilities are operating within their regulatory requirements. The proposed action would be in compliance with all applicable GEPA solid waste permit terms and conditions that routinely include specific measures to protect human health and the environment. All other projects on Guam would utilize permitted solid waste management and disposal facilities.

The increased demand on the overall solid waste handling capability would be gradually spaced over the 10 or more years of projected buildup, and the "steady-state" conditions when the proposed action to Guam has been completed. The increase in solid waste generated by the additional DoD population at AAFB would be managed by the new transfer station, recycling center, and planned additional solid waste handling trucks/equipment. Upon completion of the SW Transfer Station and Recycling Center facilities, the long-term off-base impact would consist of increased solid waste container trucks hauling the processed municipal solid waste (MSW) to the Harmon Transfer Station, and recycled waste (e.g., cardboard, scrap metal, glass) to the designated recycling contractors. Again, this increased traffic would not significantly impact the Guam solid waste infrastructure support systems.

Family housing for Alternative C would consist of an increase in housing units of approximately 11% from the current amount. The MSW from the family housing area would be managed by existing AAFB solid waste facilities.

The new Layon Landfill is designed to account for the level of MSW projections from the 2010 Final EIS. Therefore, it has the capacity to accommodate the projected MSW for the reduced levels of the current proposed action. The reduction in the generation of solid waste under the current proposed action versus the 2010 proposed action is a beneficial effect, as this increases the life of the existing Layon

Landfill. Therefore, there would be less than significant long-term direct and indirect impacts to the solid waste resources on Guam for Alternative C, both during construction and operation.

Information Technology and Communications

At the proposed cantonment area on AAFB, there is only one existing DoD IT/COMM line. That line would not be impacted unless required by road/access gate modifications. This impact would be limited to encasing this line in concrete wherever new roadways or parking areas would be constructed over this existing line, or if this line becomes otherwise subject to surface loads. Existing Building 112 at Finegayan has adequate current capacity to handle additional connections for IT/COMM, as required for Alternative C. New duct banks required for Finegayan Alternative A, as described in Section 2.6, include a duct bank of up to twelve 4-inch (10-cm) conduits looped between the main IT/COMM distribution facilities, and a system of duct banks and various conduits distributed in and around the site connecting the main distribution facilities to each building or end user. Various types of cable would be required within this system of conduits including 144 and 288 strand fiber optic cables, copper cables with 600 pair telephone lines, and smaller cables to individual buildings. Thus, there would be minimal potential for short- or long-term adverse environmental consequences to the existing DoD IT/COMM facilities at AAFB. Therefore, the direct impact to the DoD IT/COMM system is deemed less than significant both during construction and in operation.

Additional inter-base IT/COMM connectivity would be required as described in Section 2.6. This includes the connection between AAFB and the existing Tata cable landing facility in southern Guam, which would require new rights of way along some southern roads as well as the access road to the Tata facility.

The current commercial IT/COMM facilities have adequate capacity within nearby infrastructure. The existing cables within the proposed remodeled family housing area could be rerouted or demolished as required. New duct banks would be required to service the proposed cantonment area. There could be short-term lack of commercial service during the construction phase, but no permanent or long-term environmental consequences to the commercial IT/COMM infrastructure. Therefore, the direct impact to commercial IT/COMM systems is deemed less than significant both during construction and in operation.

4.3.15 Socioeconomics and General Services

4.3.15.1 Affected Environment

The affected environment for Socioeconomics and General Services on Guam are presented for the entire island of Guam and do not vary by alternative. Because the affected environment does not vary by alternative, it is only presented one time, under Alternative A. A full description of the affected environment for Socioeconomics and General Services is presented in Section 4.1.15.

4.3.15.2 Environmental Consequences

The Socioeconomics and General Services impacts under Alternative C would be island-wide, direct and indirect, short- and long-term, and would be the same as described under Alternative A in Section 4.1.15. The population change associated with Alternative C would not likely put excessive strain on Guam's public services and permitting agencies, and the estimated increases in GovGuam tax revenues would likely compensate for any increased demand that would occur. The economic impacts would be beneficial, leading to increased employment and standards of living, and impacts to Guam's housing stock and availability would not bring about reactionary development, which could have otherwise lead to dislocations in the housing market. There is a potential for sociocultural impacts to occur, but the

magnitude of the impacts could vary substantially based on policy and program choices yet to be made as how to address them.

4.3.16 Hazardous Materials and Waste

4.3.16.1 Affected Environment

The current DoD ROI on Guam for hazardous materials and waste in this section includes the Air Force properties proposed for development of the cantonment and housing and the areas affected by off-site utilities development and DoD school expansions (see Section 2.4.4.6 in Chapter 2). Air Force properties include the eastern portion of AAFB. The proposed cantonment and housing development has the potential to affect a larger area of this site.

Hazardous materials at AAFB are managed by the installation's Hazardous Materials Pharmacy, under the Logistics Readiness Squadron. This facility was established with the mission of overseeing, procuring, and minimizing the use of hazardous materials. The AAFB Hazardous Materials Pharmacy reduces the need to store large quantities of hazardous materials elsewhere on-base and allows these materials to be efficiently reordered on an as-needed basis. Unused hazardous materials are turned in to Hazardous Materials Pharmacy or DRMO for reissue or disposal.

The Air Force has requirements for readily accessible fuel and related storage facilities on Guam. The Defense Logistics Agency Energy Guam is the Defense Logistics Agency field activity managing Defense Logistics Agency's DLA's bulk petroleum products on Guam. Military vehicle fueling is provided by the DZSP21 (contractor) transportation department.

The Naval Base Guam Fuel Department manages fuel operations from the wharves at Drydock Island to storage at the Sasa Valley or Tenjo Vista tank farms, and transmission to storage tanks at AAFB. Approximately 45% of incoming fuel supplies are for Air Force operations (NAVFAC Pacific 2010).

The military pipeline system consists of Naval Base Guam and AAFB segments that span the 26 miles (42 km) from Defense Fuel Supply Point Guam to AAFB. The Air Force portion of the pipeline consists of a single 10 inch (25.4 cm) underground pipeline that covers 16.3 miles (26.2 km) and conveys JP-8 to AAFB from the Tiyan manifold to AAFB Defense Fuel Supply Point (NAVFAC Pacific 2010). There is an FY 2013 military construction authorization to construct a second 10 inch (25.4 cm) underground pipeline from Tiyan to AAFB, paralleling the existing pipeline.

Numerous fueling operations to support aircraft, vehicle operation, and emergency power generation are performed at AAFB. The majority of fuel is aviation fuel. The base has the capacity to store approximately 66,000,000 gallon (8,822,917 cubic feet) of aviation fuel. However, some aboveground fuel lines presently lack sufficient containment to meet SPCC protocols and/or regulations such as the "General Containment Rule." Fuel storage facilities on the base are required to have leak detection features and primary and secondary containment to contain unintended leaks, spills, and releases.

A base service vehicle equipment station receives commercially delivered fuel (current supplier is Mobil) two times per week. The facility is at current capacity. Service vehicles fuel up at a station along the northeast runway along Arc Light Boulevard. Fuel is provided by a commercial vendor on-island. An additional vehicle fueling facility is under construction near NWF. However, this facility is currently not operational as it does not yet meet the Defense Logistics Agency requirements.

Hazardous Materials Management

AAFB is a Large Quantity Generator (40 CFR 262.34 [d], [e], and [f]) of hazardous waste with USEPA identification handler number GU6571999519. DRMO arranges for all hazardous waste collection, transportation, and disposal via licensed contractors who ultimately dispose of the hazardous waste at permitted off-island disposal facilities (AAFB 2007).

AAFB has a Hazardous Waste Management Plan pursuant to Air Force Instruction 32-7042 that provides guidance on the generation, storage and disposal requirements and protocols of hazardous waste.

The 36th Civil Engineering Squadron Environmental Flight (CES/CEV) is responsible for overseeing the management of hazardous waste at AAFB. CES/CEV's mission statement and operating policy is to (AAFB 2008):

- Maintain a safe and healthy operation and environment.
- Comply with all applicable laws and regulations.
- Minimize the generation of all waste types and substitute less toxic materials when possible.
- Implement process changes that result in a reduced amount of waste used and recycle to the maximum practical extent.

There are 21 (or up to 26 depending on operations) satellite accumulation areas for hazardous waste on AAFB and one 90-day hazardous waste accumulation site (Building 19017). Three hazardous waste accumulation sites are located on the portion of AAFB proposed for development of cantonment/family housing under this alternative.

Contaminated Sites

As a result of historic industrial activities conducted at AAFB, groundwater beneath a portion of the area proposed for cantonment development is known or suspected to be contaminated. Contamination was found in Main Base monitoring wells. At those wells, volatile organic compounds (VOCs) and metals concentrations were detected at levels that exceeded USEPA's Maximum Contaminant Levels. No drinking water wells are located near the affected monitoring wells (Agency for Toxic Substances and Disease Registry 2002).

Installation Restoration Program Sites

There are six IRP and potentially contaminated sites located in the area of Alternative C (Table 4.3.16-1). As shown in the table, there are four sites within the proposed footprint and two sites in close proximity of the footprint. The majority of the sites have been remediated or determined to not present a risk to human health or ecological receptors. Those sites that are currently active or have land use restrictions are depicted in Figure 4.3.16-1. Active or restricted sites that may have indirect impacts (i.e., groundwater contamination) on the affected area under this alternative are depicted in Figure 4.3.16-1. These sites are listed in Table 4.3.16-1 and described in the 2010 Final EIS (Volume 9, Appendix G: EIS Resource Technical Appendix, Chapter 3: Hazardous Materials and Waste Resources, Table 3.6-1 Summary of Active Environmental Restoration Sites on AAFB, pages G-3-28 to G-3-37 and Table 3.6-2 Summary of Applicable Solid Waste Management Units and Areas of Concern Sites on AAFB, pages G-3-38 to G-3-43).

Table 4.3.16-1. Active and Restricted IRP Sites, MRP Sites and AOC within AAFB Cantonment/Family Housing Alternative

Site Name	*Area (acres)*	*Status*
Sites Within Affected Area		
Site 5-Landfill 5	69	No Further Action
Site 6-Landfill 8	8	Active (Land Use Controls)
Site 64 (AOC-I06)-Asphalt Drum Area	3.5	Active
Site 65 (AOC-I07)-Asphalt Drum Area with OEW Area	50	Active
UXO 5A MRA 255 Burn & Dump Site	6	Active
Sites That May Impact Affected Area		
Site 3-Waste Pile 3	19	Active
Site 35-Waste Pile 1	7	Active/Land Use Controls

Source: DON 2010.

Military Munitions Response Program

One MMRP site, UXO 5A MRA255 Burn & Dump Site, was identified in the area of AAFB proposed for development of cantonment/family housing under this Alternative (Figure 4.3.16-1). This site is currently active (see Table 4.3.16-1).

Toxic Substances Management

Andersen Air Force Base

There are numerous structures located on the portion of AAFB that may be affected by the proposed development of cantonment/family housing under this alternative. Any structure constructed prior to 1978 may contain LBP, ACM and PCBs.

According to USEPA, the parcel is located in an area classified as Zone 1 for Radon indicating average indoor radon levels of greater than 4 pCi/L.

4.3.16.2 Environmental Consequences

Short-term construction impacts and long-term operational impacts to hazardous materials and waste under this alternative would be similar to those described under Section 4.1.16.2 of this SEIS. Therefore, implementation of Alternative C would result in less than significant direct and indirect impacts to hazardous materials and waste.

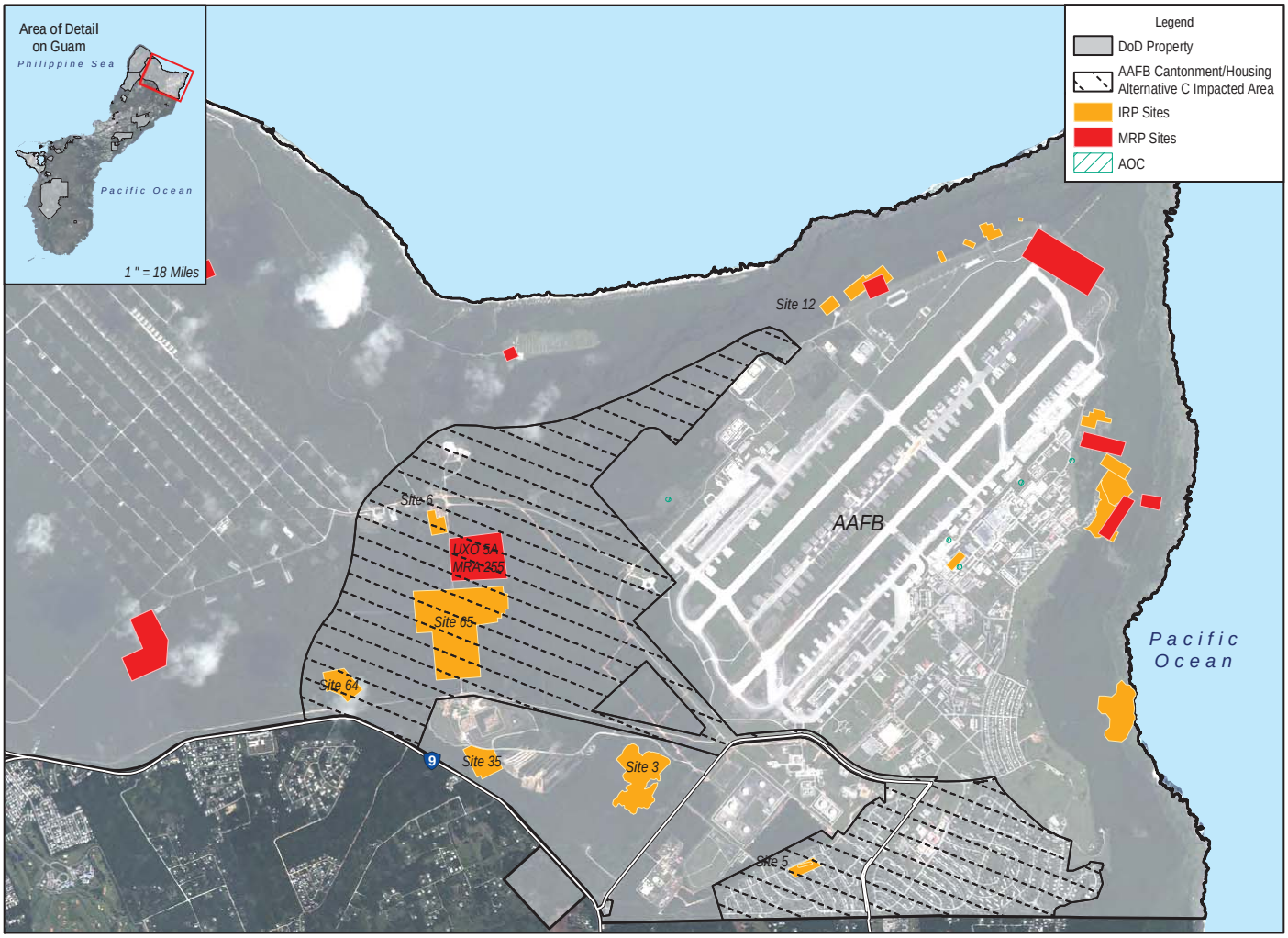


Figure 4.3.16-1
Active and Restricted IRP Sites, MMRP Sites, and AOC
in the Vicinity of AAFB Cantonment/Housing Alternative C

4.3.17 Public Health and Safety

4.3.17.1 Affected Environment

Notifiable Diseases

The Affected Environment for notifiable diseases for Alternative C is the same as discussed in Section 4.1.17.1 for Alternative A.

Mental Illness

The Affected Environment for mental illness for Alternative C is the same as discussed in Section 4.1.17.1 for Alternative A.

Operational Safety

To protect the general public from intentional or accidental entry onto AAFB, locked or manned gates are used where vehicle access is provided and a series of signs warning unauthorized personnel not to enter the area are posted along the perimeter of the installation. Unauthorized personnel are not allowed on the installation at any time.

A small arms range and EOD range are present on the northern portion of AAFB below the cliffline, north of the airfield. Activities at these ranges are conducted in accordance with SOPs to ensure the safety of both range participants as well as the public.

Due to munitions handling activities on the AAFB airfield and EOD activities north of the airfield, ESQD arcs have been established that restrict the construction of inhabited buildings and other non-munitions related activities in order to minimize potential impacts on personnel and the public from an explosive mishap. The location of ESQD arcs on AAFB is provided in the land use section of this SEIS (see Section 4.3.6).

APZs have been established for aircraft operations from the AAFB airfield at either end of the runway that extends northeast into the ocean and southwest into civilian land areas. The areas proposed for the cantonment and housing at AAFB are situated outside of the APZs. Off-base lands within the APZ were addressed in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.1.2.1: Andersen AFB, page 8-24).

Environmental Health Effects

Noise

The primary source of aircraft noise in the northern part of Guam is AAFB. There are approximately 30,000 flight operations annually at AAFB including departures, arrivals, overhead break arrivals, touch-and-go patterns, and ground-controlled approach patterns. The areas proposed for the cantonment and housing that are south of the airfield are situated within the 60 to 70 dB noise range. Areas north and west of the airfield are within the 65 to 80 dB noise range (see Figure 4.1.4-1). Details regarding current noise conditions at AAFB are provided in Section 4.3.4.1.

Water Quality

Several water wells are situated within AAFB, which have a mandated 1,000-foot (305-m) buffer identified as a wellhead protection zone. Within this zone, future activities and development are restricted to ensure contaminants are not introduced in these areas, thus protecting the integrity of the island's freshwater aquifers. Guam's freshwater aquifers are susceptible to contamination from surface activities.

GEPA requires treatment to ensure water quality meets safe drinking water standards. Section 4.3.2.1 provides details regarding current quality of potable water sources.

Hazardous Substances

Current management practices and contingency plans for the use, handling, storage, transportation, and disposition of hazardous substances associated with AAFB ensure that exposure to the environment and human contact is minimized.

The IRP focuses on cleaning up releases of hazardous substances that pose risks to the public and/or the environment. The MMRP focuses on identifying and removing MEC. Six IRP sites and one potentially contaminated site are situated within the area proposed to support the cantonment and housing on AAFB. These sites include Site 6 (Landfill 8), Site 26 (Fire Training Area 2), Site 29 (Waste Pile 2), Site 64 (Asphalt Drum Area), Site 65 (Asphalt Drum and Ordnance and Explosive Waste Area), Site 77 (Operational Support Building 4), and Solid Waste Management Unit 37A (Vehicle Maintenance Pit). Landfill 8 contains asphalt, asphaltic waste, and metal. Waste fuel is the contaminant of concern at Site 26. Site 29 is an area that was used to store drums of asphalt, tar, and oil. Site 64 is an area that was used to store drums of asphalt and tar. Contaminants identified at Site 65 include petroleum, oils, and lubricants; various debris; MEC; scrap metal; tires; polynuclear aromatic hydrocarbons; heavy metals including lead; concrete; and asphalt. Contaminants identified at Site 77 include scrap metal, aircraft and automobile parts, and UXO/MEC. Site 37A is a vehicle maintenance pit that is managed based on the hazardous substances utilized at the site.

For Site 6, an interim removal action has been completed and land use controls are in place. No further action has been recommended for Sites 26, 29, and 77. For Site 64, a remedial investigation/feasibility study has been completed and a ROD prepared recommending land use controls. For Site 65, Remedial Investigation fieldwork has been completed; the explosives component of the site would be addressed under the MMRP; and the remainder of the site has had a Remedial Investigation/Feasibility Study completed and a remedial action ROD prepared. The hazardous materials and waste section of this SEIS (see Section 4.3.16) provides additional detail for the status of IRP and MMRP sites.

Unexploded Ordnance

The presence of UXO within the proposed AAFB cantonment and housing area is not known. However, Guam was an active battlefield during WWII. As a result of the occupation by Japanese forces and the assault by Allied/American forces to retake the island, unexploded military munitions may still remain.

Traffic Incidents

No high crash frequency locations have been identified in the vicinity of the proposed AAFB cantonment and housing area.

4.3.17.2 Environmental Consequences

Potential direct and indirect impacts on public health and safety from implementation of Alternative C would be similar to those discussed under Alternative A.

Notifiable Diseases

Potential increases in notifiable diseases for Alternative C would be the same as discussed in Section 4.1.17.2 for Alternative A.

Mental Illness

Potential increases in mental illness for Alternative C would be the same as discussed in Section 4.1.17.2 for Alternative A.

Operational Safety

To protect the general public from intentional or accidental entry onto AAFB, locked or manned gates would continue to be used where vehicle access is provided and a series of signs warning unauthorized personnel not to enter the area would remain posted along the perimeter of the installation. Unauthorized personnel would not be allowed on the installation at any time.

The primary operational activities that would occur within the cantonment and housing area include:

- Administrative, supply, service, and maintenance functions for operational units.
- Base support functions.
- Unaccompanied personnel housing and related support functions (e.g., school, child development center, youth center).
- Training functions (i.e., classroom instruction and non-live fire training).
- Community support functions.

The areas proposed for the cantonment and housing at AAFB are situated outside of the APZs. Specific and documented procedures would be in place to ensure the public is not endangered by operations and training activities. Therefore, Alternative C would result in no direct or indirect impacts on public health and safety (resulting from operations and training activities).

Explosive Safety

Construction and infrastructure improvements related to the proposed military relocation to AAFB would be consistent with established ESQD arcs on AAFB. However, munitions are transported several times per week from the munitions operations and storage area on NWF to the AAFB airfield along a route to the north and east of the proposed cantonment area. The secondary munitions route traverses the middle of the proposed cantonment area. The long-term risk associated with the transport of munitions adjacent to and through the proposed cantonment area has the potential to cause the evacuation of up to 100% of the cantonment area in the event that a munitions transport incident occurs.

In addition to munitions transportation, another concern is the blast zone associated with the Vehicle Inspection Facility near the North Gate. This gate alignment was developed prior to the consideration of the Marine Corps cantonment area being considered in the same area.

Despite SOPs being in place to ensure the safe transportation of munitions, and incident response procedures in place in the event of a munitions transport incident or explosives incident at the North Gate, a significant direct impact related to explosive safety could occur. Without re-siting the proposed development, this potential significant direct impact cannot be mitigated. By comparison, Alternatives A, B, D, and E would have no impacts associated with explosive safety.

Electromagnetic Safety

Use of AAFB to support cantonment area and housing requirements for relocated Marines would be conducted so that new developments are consistent with established EMR hazard zones. Because electromagnetic emission sources would be operated in accordance with applicable safety standards and the public would be excluded from entering areas where emission sources are located, potential long-term impacts from electromagnetic emissions on public health and safety would not result in any greater safety

risk. Therefore, no direct or indirect impact on public health and safety related to electromagnetic emissions is anticipated.

Construction Safety

Because a health and safety program would be implemented for construction activities and the public would be excluded from entering construction areas, potential short-term construction impacts on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to construction activities is anticipated.

Environmental Health Effects

Noise

Potential short-term construction and long-term operational noise emissions associated with Alternative C would be similar to those discussed under Alternative A. Enforcement of OSHA guidelines for hearing protection for workers would be the responsibility of the construction contractor. The public would be excluded from entering construction areas. Therefore, short-term construction noise impacts on public health and safety would be less than significant. Long-term operational noise from activities occurring on AAFB would be similar to current noise levels. The area proposed for the cantonment and housing that are south of the airfield are situated within the 60 to 70 dB noise range and are compatible with residential development. Areas north and west of the airfield are within the 65 to 80 dB noise range. These areas would mostly be incompatible for residential development but would allow for operations activities. Construction of buildings in these areas should implement noise level reduction measures to reduce interior noise levels to allow normal conversation. Existing aircraft noise is not at a level that would result in the loss of hearing of cantonment or housing area occupants. Therefore, the overall direct or indirect impacts associated with noise to human health and safety would be less than significant.

Water Quality

Potential water quality impacts associated with Alternative C would be similar to those discussed under Alternative A. Groundwater withdrawal would likely increase. However, sustainability practices would be implemented to reduce the amount of groundwater needed. The resulting total annual groundwater production would be less than the sustainable yield, and monitoring of groundwater chemistry would identify any emerging issues to ensure no harm to the water supply. Water wells on AAFB have a mandated 1,000-foot (305-m) buffer identified as a wellhead protection zone. Proposed development and operational activities would be conducted in accordance with GEPA guidance and BMPs to minimize the potential for contaminants to be introduced in these areas. Therefore, direct and indirect public health and safety impacts from long-term increased demand on potable water and potential water-related illnesses would be less than significant.

Hazardous Substances

Potential direct impacts from hazardous substances for Alternative C would be similar to those discussed under Alternative A. The use, handling, storage, transportation, and disposition of hazardous substances would be conducted in accordance with applicable hazardous material and waste regulations, and established BMPs and SOPs to ensure that the health and safety of workers and the general public is maintained.

IRP investigations and/or remediation activities, as necessary, would continue in an effort to clean up past releases of hazardous substances and receive regulator concurrence that necessary actions have been completed to ensure the safety of the public. No off-site population is near the IRP sites. Building

construction is not proposed within the footprint of IRP sites. Based on investigations of the contaminants associated with sites on AAFB (within proposed cantonment and housing development areas), no health hazards have been identified. Because hazardous substance management and IRP investigative/cleanup activities would be conducted in accordance with applicable regulations and established BMPs and SOPs, no direct or indirect impacts on public health and safety are anticipated.

Unexploded Ordnance

Potential direct impacts from UXO under Alternative C would be similar to those discussed under Alternative A. With the exception of public access provisions outlined through the 2011 PA process (see Section 4.4.10, Cultural Resources), the general public would be excluded from entering construction zones and training areas. To reduce the potential hazards related to exposure to MEC, ESS documentation would be prepared that outlines specific measures that would be implemented to ensure the safety of workers and the public. BMPs would be implemented to identify and remove potential MEC items prior to the initiation of ground-disturbing activities. UXO personnel supervision would occur during earth-moving activities and MEC awareness training would be provided to construction personnel involved in grading and excavations prior to and during ground-disturbing activities. In addition, the DON provides MEC awareness training to GovGuam and other public representatives allowing access to project sites to facilitate surveys or collection of natural resources or items of cultural significance prior to conducting vegetation clearance. Because UXO would be identified and removed prior to initiating construction activities and construction personnel would be trained as to the hazards associated with UXO, potential direct impacts from encounters with UXO would be minimized and less than significant.

Traffic Incidents

Because no high crash frequency intersections are located near AAFB and the overall long-term potential increase in the number of traffic accidents as a result of the increase in personnel would be minimal, there would be a less than significant impact on the health and safety of the citizens of Guam (from traffic incidents).

4.3.18 Environmental Justice and the Protection of Children

4.3.18.1 Affected Environment

As described in Section 4.1.18, the affected environment for environmental justice and protection of children analysis is the entire island of Guam. Therefore, the affected environment for Alternative C is the same as for Alternative A. In addition, the Alternative C is located in the northern area of the island, the same region as Alternative A. The villages of Dededo and Yigo are within this region.

4.3.18.2 Environmental Consequences

Potential impacts to environmental justice populations under Alternative C would be to noise, recreation, socioeconomics and general services (including health services), and public health and safety.

Noise

The potential impacts would be the same as Alternative A.

Recreation

Impacts are generally island-wide and would be the same as described for Alternative A.

Socioeconomics and General Services

Impacts are generally island-wide and would be the same as described for Alternative A, as would the identified measures to mitigate impacts.

Public Health and Safety

Impacts are generally island-wide and would be the same as described for Alternative A, as would the identified measures to mitigate impacts.

4.4 BARRIGADA CANTONMENT/HOUSING - ALTERNATIVE D

Under Alternative D, the proposed development of a cantonment area and family housing would occur at Barrigada. Details about this alternative are provided in Section 2.4.4.4 and the proposed site is illustrated in Figures 2.4-10 and 2.4-11.

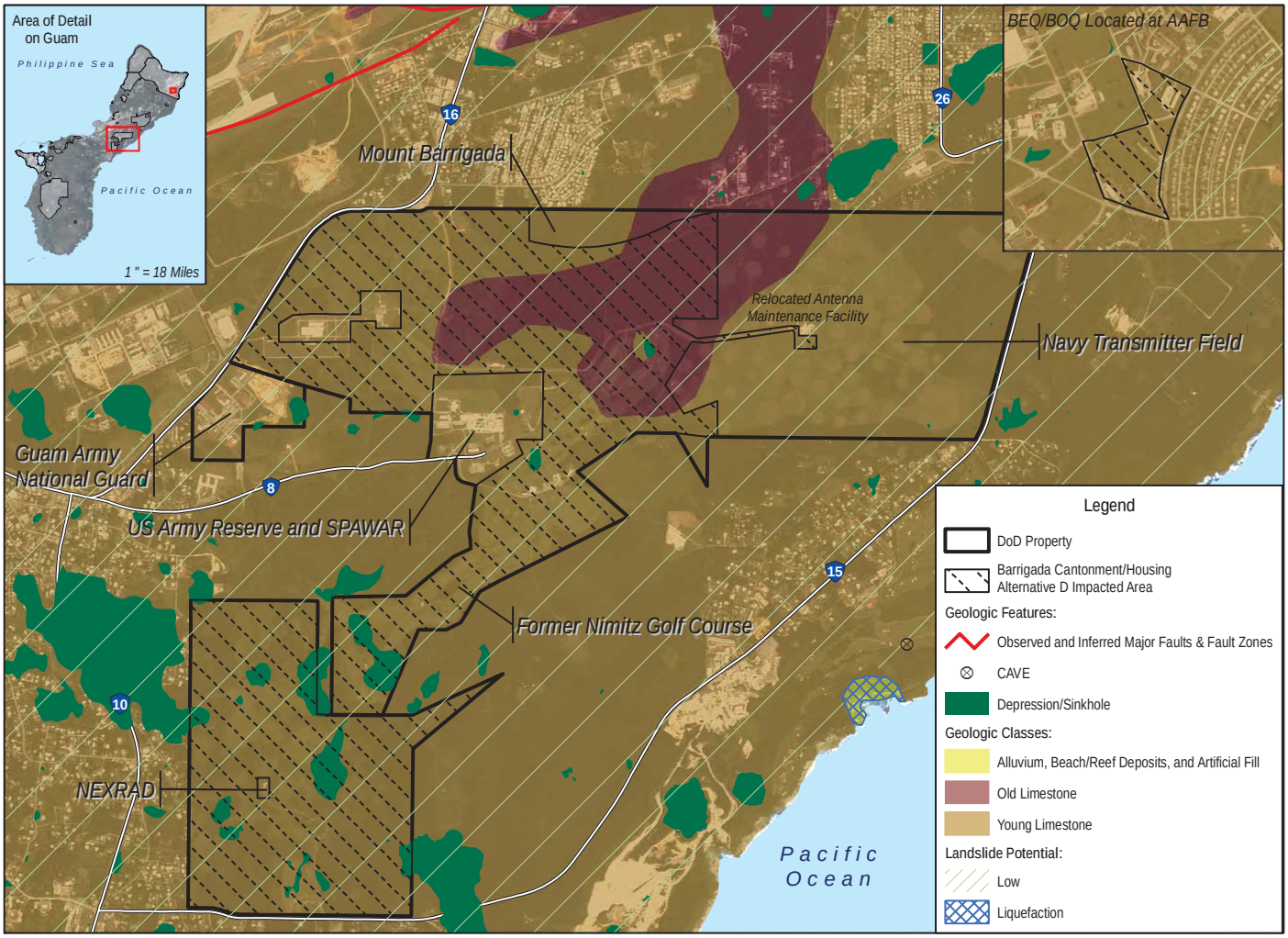
4.4.1 Geological and Soil Resources

4.4.1.1 Affected Environment

The affected environment for geological and soil resources under Alternative D is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.1.3.2: Barrigada, page 3-21) which is summarized below for reference. The affected environment for the BEQ/BOQ component of Alternative D located at AAFB is the same as described for Alternative C. In addition, the geological and soils affected environment for projects common to all alternatives (i.e., school expansions and off-site utilities) would be similar to that described under Alternative A. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for geological and soil resources, but it would reduce some potential impacts to geological and soil resources, that were determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, as described in the analysis of environmental consequences for Alternative D below.

The proposed Barrigada cantonment/family housing area is located in the east-central portion of Guam's limestone structural province (Figure 4.4.1-1). In the northern part of the footprint, the lower slopes of Mount Barrigada rise above the limestone plateau to an elevation of 440 feet (134 m) above MSL (Figure 4.4.1-2). Within the rest of the Alternative D footprint, land slopes gently downward toward the southwest. Barrigada bedrock consists primarily of young (Mariana) limestone with some older (Barrigada) limestone underlying the northwestern corner of the footprint (Figure 4.4.1-1). Similar to Finegayan, the limestone bedrock underlying is the geologic setting for sinkhole formation (see Section 3.1.1.1). Based on available topographic and field data, there are 15 features that have been preliminarily identified as sinkholes/depressions that may contain sinkholes in the Alternative D footprint.

The majority of the Barrigada footprint is covered by three soil types, Guam Cobbly Clay Loam, Pulantat-Chacha Clay, and Cha-Cha clay (Figure 4.4.1-2; Young 1988). Guam Cobbly Clay loam is shallow (less than 9 inches [25 cm] deep) well-drained soil. This soil has a "low" erodibility factor and is not prime farmland (Young 1988). Pulantat-Chacha Clay contains two subgroups that often occur near one another, but have different properties. The Pulantat soils are shallow, well-drained clays that have a slight water erosion hazard, while the Cha-Cha clays are deeper, poorly drained, and have a moderate erosion hazard. Ritidian-Rock Outcrop Complex soils cover a small area on the slopes of Mount Barrigada. These soils are shallow, well-drained and stony, with limestone bedrock outcrops. Shallow slopes of the limestone plateau protect the Guam Cobbly Clay Loam, Pulantat-Chacha Clay, and Cha-Cha clay from erosion. On the steeper slopes of Mount Barrigada, runoff is very slow and the water erosion hazard of the Ritidian-Rock Outcrop Complex is slight (Young 1988).



0 0.3 0.6 Miles
0 0.3 0.6 Kilometers

Figure 4.4.1-1
Geologic Features in the Vicinity of
Barrigada Cantonment/Housing Alternative D

Sources: COMNAV Marianas 2008; GovGuam 2008; NAVFAC Pacific 2013; Taborosi 2004; WERI 2001

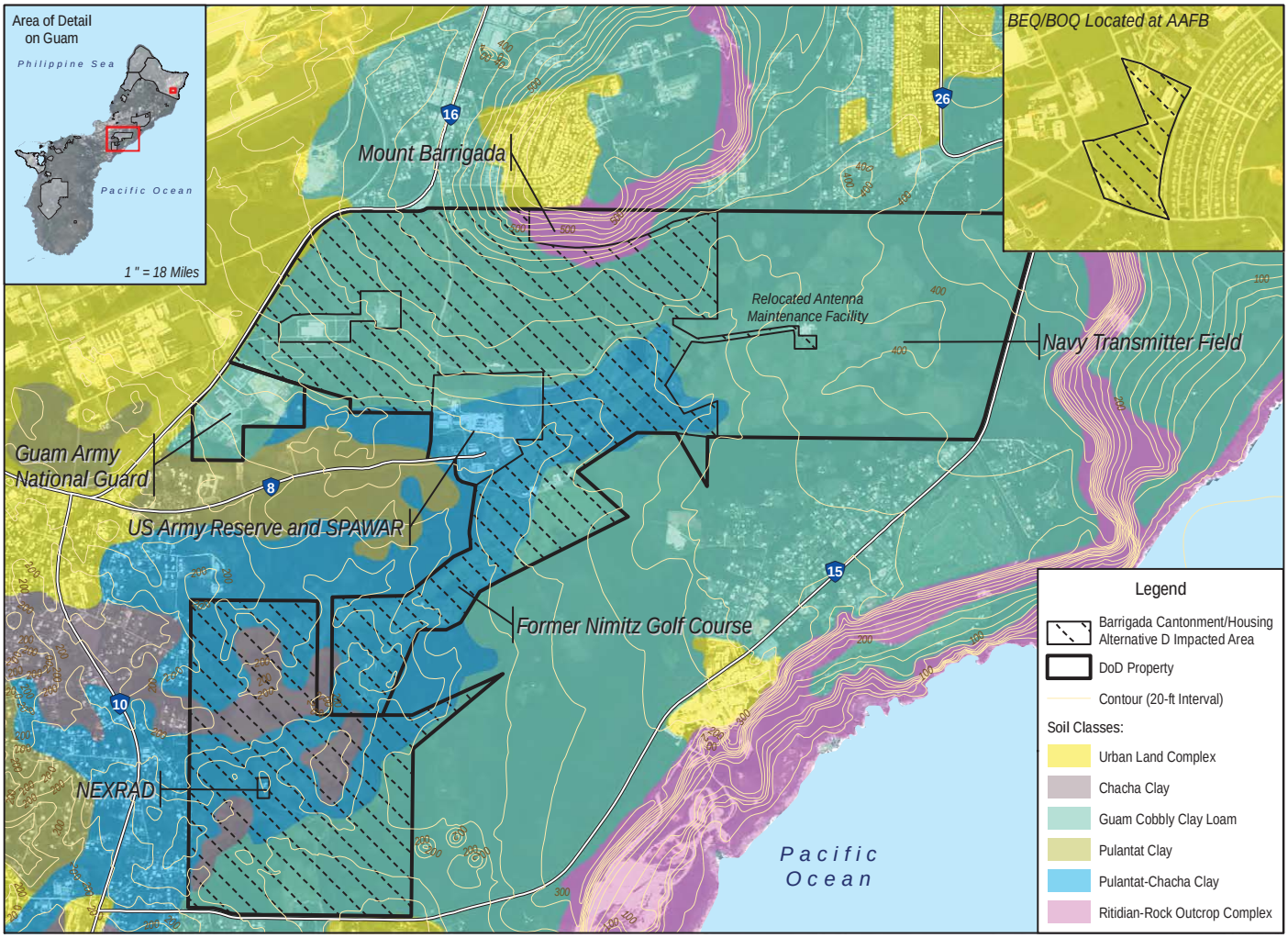


Figure 4.4.1-2
Soils in the Vicinity of Barrigada Cantonment/Housing Alternative D

Prime farmland soils, as defined by the USDA, are soils best suited to producing food, seed, forage, fiber and oilseed crops, favorable for economic production and sustained high yield, with minimal inputs of energy and resulting in least damage to the environment (Young 1988). None of the soils in the proposed project area are identified as prime farmland by the USDA. However, the Pulantat-Chacha Clay and Cha-Cha clays are capable of supporting agriculture (see Figure 4.4.1-2; Young 1988).

With respect to geologic hazards (see Section 3.1.1.1) there are no known bedrock faults mapped within the Alternative D footprint (see Figure 4.4.1-1). The overall likelihood for landslides at Barrigada is low due to the general lack of steep slopes. The consolidated limestone bedrock at Barrigada is not subject to liquefaction because it does not lose cohesiveness in response to ground shaking during an earthquake. The lowest elevations (approximately 235 feet [71 m]) at Barrigada in the Alternative D footprint are higher than the maximum observed wave vertical run-up for tsunamis recorded for Guam. Thus, the Alternative D site is not subject to tsunami inundation. The limestone bedrock in the area of Alternative D presents a potential hazard of surface instability and collapse due to sinkholes.

4.4.1.2 Environmental Consequences

Potential geology and soil impacts addressed in this section are limited to elements of the proposed action that could affect onshore landforms or that could be affected by geologic hazards. Potential soil contamination issues are addressed in Section 4.4.16.2 of this SEIS (Hazardous Materials and Waste).

Construction

Construction of the new cantonment/family housing, associated support facilities, and roads associated with Alternative D would include the same activities as described for Alternative A.

Grading for construction of the cantonment/family housing areas and associated infrastructure would include 3,510,000 yd^3 (2,683,589 m^3) of cut (excavation) and 2,618,000 yd^3 (2,001,606 m^3) of fill, resulting in a net of 892,000 yd^3 (681,983 m^3) of cut material available for use as needed. Similar to Alternative A, the volume of excavation and fill would be used to level minor irregularities in the limestone surface to create a buildable surface for the construction of buildings, parking lots, and roadways, and is not anticipated to create major elevation changes. Alternative D would involve the second largest excavation volume of the five action alternatives for the cantonment and family housing (Alternative E would be the largest). The only development proposed in the northern, steeper portion of the Barrigada footprint would be construction of a water tank (see Figure 2.4-10 in Section 2.4.4.4 of this SEIS). Construction of this tank would involve minimal excavation and so would not result in a significant impact to topography. Therefore, with construction of Alternative D there would be a less than significant direct long-term impact to topography and slope stability, similar to that described for Alternative A.

Under Alternative D, the same construction activities would take place as under Alternative A, in similar geologic, soil and seismic conditions. Although some soil types are different at Alternative D (Pulantat-Cha-Cha clay) the overall topography and soil characteristics are similar: low to moderate erodibility and no prime farmland. The same BMPs described for Alternative A would be implemented for Alternative D. Therefore, under Alternative D, the construction impacts would be similar to those for Alternative A: less than significant direct short-term impacts to soils from erosion, and no direct or indirect impact to agricultural soils. Given compliance with 22 GAR Chapter 10 § 10106F, there would be no adverse impacts to sinkholes, so direct short-term impacts to sinkholes would be less than significant. Direct and indirect impacts associated with geologic hazards would be less than significant.

Construction impacts for the BEQ/BOQ located at AAFB would be similar to those described for Alternative C.

Under Alternative D, construction of the utility and school expansions that are common to all alternatives would comprise the same activities, and would occur in similar geologic, soil, and seismic conditions as for Alternative A. The same BMPs described for Alternative A would be implemented for Alternative D. Therefore, under Alternative D, the construction impacts of these components would be similar to those for Alternative A.

Operation

Under Alternative D, the same residential, recreational, commercial, and administrative uses would take place at Barrigada as under Alternative A, where geologic, soil and seismic conditions are similar to those of Alternative A. Ground disturbance would be minimal and would take place on land that was previously disturbed during the construction phase. No prime farmland is identified within the Alternative D project footprint, so there would be no direct or indirect impacts to agricultural soils as a result of Alternative D operations. The same erosion minimization measures, sinkhole BMPs and seismic design requirements, described for Alternative A would apply to Alternative D. Therefore, with the operation phase of Alternative D there would be no direct or indirect impacts to topography and slope stability, and less than significant direct long-term impacts to soils from erosion. Given compliance with 22 GAR Chapter 10 § 10106F, there would be no adverse impacts to sinkholes. This would minimize potential geologic hazards associated with sinkholes and reduce potential direct long-term impacts to sinkholes to less than significant. Direct and indirect impacts associated with geologic hazards would be less than significant.

Operation impacts for the BEQ/BOQ located at AAFB would be similar to those described for Alternative C.

Under Alternative D, operation of the utility and school expansions that are common to all alternatives would comprise the same activities, and would occur in similar geologic, soil, and seismic conditions as for Alternative A. The same BMPs described for Alternative A would be implemented for Alternative D. Therefore, under Alternative D, the operational impacts of these components would be similar to those for Alternative A.

4.4.2 Water Resources

4.4.2.1 Affected Environment

The affected environment for water resources in the Alternative D cantonment/family housing project area is described in the 2010 Final EIS Volume 2, Chapter 4: Water Resources, Section 4.1.2.1: Andersen AFB, pages 4-25 to 4-26 and Section 4.1.3.3: Barrigada, pages 4-35 to 4-38). The affected environment for the proposed approximately 11 new wells, school expansions, and off-site utilities common to all cantonment/family housing alternatives would be the same as described under Alternative A in Section 4.1.2.1 of this SEIS.

Surface Water

As indicated in the 2010 Final EIS, surface water resources in the Barrigada cantonment/family housing project area are limited to small man-made ponds within the Nimitz Golf Course and wetlands (see discussion in *Wetlands* section below). The man-made ponds are not jurisdictional waters of the US. There are no surface water resources in the BEQ/BOQ project area at AAFB, or the utility corridor to AAFB. The Barrigada site averages 95 inches (241 cm) of rainfall annually. With the higher clay content, steep grades, and sizable off-site contributing stormwater basins, this area has the potential to experience

substantial stormwater runoff flows. The general stormwater overland flow direction is from northeast to southwest and ultimately enters the subsurface karst limestone structure through sinkholes and depressions along the western side of the site (Figure 4.4.2-1). Existing impervious areas on the Barrigada project area amount to 13 acres (5 ha), or 1.1% of the proposed Barrigada impacted area of 1,194 acres (483 ha). There are no 100-year flood zones identified within the proposed construction area. 500-year flood zones identified within the proposed construction area are shown in Figure 4.4.2-1.

Groundwater

As indicated in the 2010 Final EIS, the Barrigada project area is underlain primarily by very permeable limestone in the Mangilao and Agaña basins of the NGLA. The utility corridor to AAFB would overlie the Finegayan, Yigo, and Agaña basins of the NGLA and the BEQ/BOQ project area at AAFB would overlie the Andersen Basin of the NGLA. The circumstances concerning the groundwater model developed by the USGS (USGS 2013c) and the current well production are the same as described under Alternative A in Section 4.1.2.1 of this SEIS.

Nearshore Waters

As indicated in the 2010 Final EIS, the Barrigada project area is located inland and does not contain any nearshore waters. The BEQ/BOQ project area on AAFB is located near Tarague Beach and the Pati Point Marine Preserve, which are classified as having M-1 water quality and the use is primarily recreational.

The Barrigada project area would be served by the Agaña WWTP, which discharges into Agaña Bay. As discussed in the 2010 Final EIS (Volume 6, Chapter 6: Water Resources, Section 6.2.4.1: Basic Alternative 1a (Preferred Alternative), pages 6-17 to 6-20), beaches in Agaña Bay are included in GEPA's impaired water bodies 303(d) list for bacteria and USEPA Region 9 approved a TMDL for beaches in Agaña Bay in March 2010. The TMDL includes a load allocation for bacteria (*Enterococci*) for the Agaña WWTP that would be imposed under an NPDES permit (USEPA and GEPA 2009). An upgrade to the Agaña WWTP treatment systems is required by the USEPA to support the achievement of the TMDL for bacteria at Tanguisson Beach (*Enterococci*) and attainment of water quality goals (USEPA and GEPA 2009).

A 2011 Court Order required primary treatment upgrades at the Agaña WWTP. In April 2013, the USEPA issued a new NPDES permit for the Agaña WWTP requiring treatment upgrades at the facility for up to 12 MGd (45 MLd) (USEPA 2013b). The primary treatment upgrades were substantially completed in March 2014. See Section 4.4.14, Utilities in this SEIS for additional details on the Agaña WWTP.

Wetlands

As indicated in the 2010 Final EIS, nine wetlands were identified in surveys conducted in 2010 on or adjacent to the Navy Barrigada and Air Force Barrigada properties. There are no wetlands at the BEQ/BOQ project area on AAFB or along the utility corridor to AAFB. Recent on-site confirmation surveys were conducted on November 7 and December 4-11, 2012 for this SEIS. The on-site confirmation (as well as the 2010 survey) was a non-jurisdictional wetland delineation (delineation being the establishment of wetland boundaries). A jurisdictional delineation establishes the boundaries of wetlands that are subject to requirements in the CWA and its implementing regulations and requires the approval of the USACE.

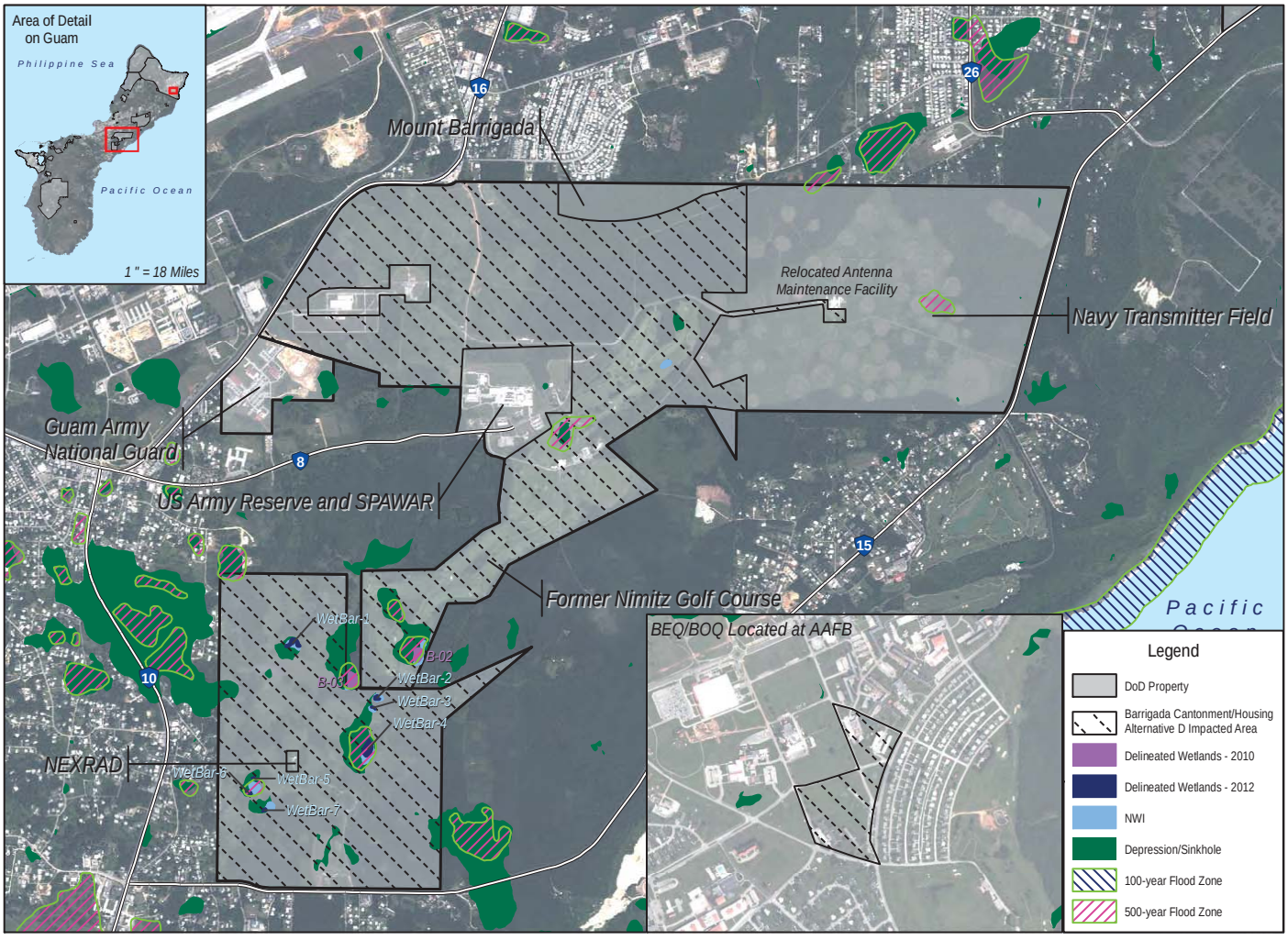


Figure 4.4.2-1
Water Resources and Wetlands in the Vicinity of
Barrigada Cantonment/Housing Alternative D

Sources: WERI 2001; FEMA 2007; USFWS 2010; NAVFAC Pacific 2010, 2013

The 2012 field delineation confirmed the seven wetlands on Air Force Barrigada that were identified in the 2010 surveys. There are a total of 3.2 acres (1.3 ha) for the eight wetlands on Navy Barrigada and Air Force Barrigada (see Figure 4.4.2-1 and Table 4.4.2-1) (NAVFAC Pacific 2010b, 2013a). In addition, there is a 1.1-acre (0.4-ha) wetland on non-federally owned lands between Navy Barrigada and Air Force Barrigada. All of the wetlands are associated with topographic depressions. The wetlands are palustrine emergent wetlands with persistent vegetation (PEM1) that are either seasonally flooded/saturated (PEM1E) or seasonally flooded (PEM1C). The acreage for each wetland is provided in Table 4.4.2-1 and the locations are shown in Figure 4.4.2-1. WetBar-6 contained shallow, seasonally ponded water (water was present in December 2012) (NAVFAC Pacific 2013a). These wetlands are all considered potentially jurisdictional pending a Jurisdictional Determination by the USACE.

Table 4.4.2-1. Summary of Delineated Wetlands at Barrigada

Wetland	*Palustrine Emergent (acres)*	
	Seasonally Flooded	*Seasonally Flooded/Saturated*
WetBar-1	-	0.6
WetBar-2	-	0.2
WetBar-3	-	0.1
WetBar-4	-	1.0
WetBar-5	-	0.1
WetBar-6	0.2	-
WetBar-7		0.1
B-02		0.9
B-03		1.1
Total	**0.2**	**4.1**

Note: B-03 is located adjacent to, but outside of Barrigada.
Sources: NAVFAC Pacific 2010b, 2013b.

4.4.2.2 Environmental Consequences

Construction

General construction impacts to water resources would be similar to those described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-84 to 4-88) and under Alternative A in Section 4.1.2.2 of this SEIS. Short-term construction impacts associated with the proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities common to all cantonment/family housing alternatives would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be no impacts to surface water, nearshore waters, and wetlands and less than significant short-term, direct impacts to groundwater for these common elements.

In addition, under Alternative D there would be construction activities associated with the proposed cantonment/family housing at Barrigada, the BEQ/BOQ on AAFB, and the utility corridor to AAFB. Alternative D would occur in an area that contains potentially jurisdictional wetlands, and therefore would be required to comply with the Construction General Permit as described under Alternative A.

Construction under Alternative D would result in the potential for short-term increases in stormwater runoff and erosion. However, through compliance with the Construction General Permit and Program SWPPP and implementation of a site-specific SWPPP and associated erosion control, runoff reduction, and sediment removal BMPs (see Table 4.1.2-2), these short-term effects would be minimized and off-site transport of stormwater runoff would be unlikely unless during extreme weather events (i.e., typhoons). Specifically, the site-specific SWPPP would identify appropriate BMPs for the site that would

serve to contain runoff and sediment on-site by reducing the flow rate of runoff and thereby minimize transport of suspended sediment through settling and promote infiltration of runoff.

Surface Water

No buildings/structures would be constructed in the 100-year flood zone. However, some stormwater detention basins could be constructed in the 500-year flood zone and all construction in the 500-year flood zone would be in compliance with EO 11988 as it would not be categorized as a "critical action." Surface waters within the proposed construction areas under Alternative D are limited to man-made ponds and wetlands (see *Wetlands* section below for discussion of potential direct impacts to wetlands). Construction would impact the man-made ponds within the Nimitz Golf Course, but these features are not considered jurisdictional waters of the US. Potential indirect effects to wetland areas from stormwater runoff would be minimized by adhering to the provisions of the Construction General Permit and implementing of a Program SWPPP and site-specific SWPPP and associated BMPs that would address site- and activity-specific surface water protection requirements. Therefore, construction activities associated with Alternative D would result in less than significant short-term impacts to surface waters.

Groundwater

Construction activities under Alternative D would include stormwater runoff protection measures that would also serve to protect groundwater quality. By adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific water resource protection requirements, there would be a reduction in stormwater pollutant loading potential and thus a reduction in pollution loading potential to the underlying groundwater basins of the NGLA. As described under Alternative A, an environmental and hydrogeologic assessment for the selected alternative would be performed for sinkholes within the project development footprint to ensure adverse effects to groundwater resources would not occur. Direct impacts associated with the induced civilian growth and construction/DoD workforce demand on potable water and the construction of the proposed approximately 11 new wells at AAFB would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS.

Potential increases in the rate of sewage spills associated with the induced civilian growth and construction/DoD workforce would result in significant indirect impacts to groundwater quality as described under Alternative A in Section 4.1.2.2 of this SEIS. Mitigation for these impacts would be the same as described in Section 4.1.2.2 for Alternative A.

Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs), the environmental and hydrogeologic assessment for sinkhole protection (if encroachment is unavoidable), siting and construction of wells in accordance with GEPA regulations, minimal increase in water demand or withdrawal from the NGLA during the construction phase, and DoD assistance in identifying funding to upgrade sewer lines, construction activities associated with Alternative D would result in less than significant direct impacts to groundwater.

Nearshore Waters

Short-term impacts to nearshore waters from general construction would be similar to those described under Alternative A in Section 4.1.2.2 of this SEIS. The Barrigada cantonment/family housing project area would be located at an elevation ranging from approximately 200 to 400 feet (60 to 120 m) and more than 0.5 mile (0.8 km) from nearshore waters and the BEQ/BOQ project area on AAFB would be located at an approximate elevation of 500 feet (150 m) and 0.7 mile (1.2 km) from nearshore waters. Given

compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP and the distance from nearshore waters (i.e., 0.5 mile [0.8 km]), off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely (see discussion of BMPs under *Construction*) and discharge to nearshore waters would not occur. Therefore, construction activities associated with Alternative D would result in no direct or indirect impacts to nearshore waters from stormwater runoff associated with increased impervious areas.

Induced civilian and construction/DoD workforce growth during construction of the cantonment/family housing facilities under Alternative D would increase demand for wastewater treatment (at the Agaña WWTP for facilities located at Navy Barrigada and at the Northern District WWTP for facilities located at AAFB), and increase requirements for disposal of treated wastewater. As discussed in Section 4.4.14, Utilities in this SEIS, direct and indirect long-term impacts to wastewater from DoD and organic civilian population growth are estimated to increase the maximum monthly wastewater flows to the Northern District WWTP by 2028. Due to the reduced population projection and related smaller increase in demand under the 2012 Roadmap Adjustments, these increases in wastewater discharge from the Agaña WWTP and the Northern District WWTP would be less than under the No-Action Alternative. However, as discussed in Section 4.4.14, Utilities in this SEIS, upgrades to the Agaña WWTP and Northern District WWTP are already needed in order for the plants to achieve compliance with the current NPDES permits. Increasing the wastewater discharge from a non-compliant treatment plant could result in significant indirect impacts to nearshore waters during the period of non-compliance. Potential mitigation to address this significant impact would be similar to that described in the nearshore waters impact discussion for construction of Alternative A in Section 4.1.2.2, but would also include upgrades to Agaña WWTP. Therefore, with the mitigation to upgrade the WWTPs treatment systems, the impact to nearshore waters could be beneficial in the long-term because the total volume of wastewater discharge from the WWTPs would receive a higher level of treatment. However, until the WWTP upgrades are completed there would be an indirect and unmitigable significant impact to nearshore waters during construction.

Wetlands

Implementation of Alternative D could result in direct impacts (fill) to potentially jurisdictional wetland areas in the Barrigada cantonment/family housing project area (see Figure 4.4.2-1). By comparison, there would be no impacts to wetlands under the other proposed cantonment/family housing alternatives. No wetlands are located in or near the construction areas associated with the BEQ/BOQ on AAFB or the utility corridor to AAFB.

Through design and avoidance measures, it is anticipated that most of the wetlands identified in the Barrigada cantonment/family housing project area would be preserved. However, some of the smaller wetlands may be filled if determined to be non-jurisdictional or avoidance would not be possible. Direct impacts (fill) to jurisdictional wetlands would be a significant impact. The wetlands that would potentially be directly impacted at Barrigada include WetBar 7 and a small portion of B-02 (see Figure 4.4.2-1 and Table 4.4.2-1) and amount to 0.1 acre (0.04 ha). If these wetland areas are determined to be jurisdictional by the USACE, and therefore subject to Section 404 (CWA) requirements, the Marine Corps would first attempt to avoid impacts. If avoidance is not possible, then the Marine Corps would obtain a permit from the USACE to fill the wetlands and comply with minimization and mitigation measures outlined in the permit. Unavoidable impacts to jurisdictional wetlands would be mitigated by creating new wetlands, restoring or enhancing existing wetlands, or preserving existing wetland areas on Guam to, at a minimum, replace the area filled. If Alternative D is chosen and wetlands cannot be avoided, the Marine Corps understands that a LEDPA determination must be made as part of the permitting process and that if the

USACE determines this alternative is not the LEDPA, a Section 404 permit under the CWA cannot be granted. Through implementation of the mitigation measures and procedures identified above, significant impacts to wetlands would be reduced to a level below significant.

Potential short-term, indirect effects to other nearby down-gradient wetland areas from stormwater runoff would be less than significant through compliance with the Construction General Permit and implementation of BMPs, as discussed under *Surface Water*.

Operation

Alternative D would incorporate a LID approach in the final planning, design, and construction of the stormwater management system as described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-85 to 4-87) and under Alternative A in Section 4.1.2.2 of this SEIS. Operational impacts associated with the proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities common to all cantonment/family housing alternatives would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be no direct or indirect impacts to surface water, nearshore waters, and wetlands and less than significant long-term impacts to groundwater for these common elements.

The proposed stormwater management system infrastructure improvements included as part of the proposed action would incorporate LID measures and BMPs for compliance with local and federal requirements that are designed to minimize potential long-term, indirect impacts to downstream development, sensitive water resources, and ecology, as described under Alternative A in Section 4.1.2.2 of this SEIS. Alternative D would be implemented in accordance with all applicable orders, laws, and regulations including the preparation and implementation of a SWPPP, SWMP, and SPCC plan that would control runoff and minimize potential leaks and spills.

Under Alternative D, the total impervious area on the Barrigada project area would increase by 319 acres (129 ha). This increase from 1.1% to 28% impervious area, for a total of 332 acres (134 ha), would result in an associated increase in stormwater runoff volume for each of the design storm events. The utility corridor to AAFB would result in minimal increase in impervious area. Alternative D would result in increased runoff of 446 acre-feet (550,000 m^3) and 708 acre-feet (873,400 m^3) from the 25-year and 100-year design storms, respectively. However, the project design would include vegetated swales for conveyance and treatment and detention/retention ponds capable of capturing, storing, and treating additional runoff from the 25-year design storm (see Appendix F for examples of LID applications that would be used and conceptual design of stormwater runoff routing and pond locations). As part of the planning design, the project area was delineated into sub-basins with stormwater conveyance systems to route discharges to appropriately sized detention basins. For each sub-basin, water quality treatment strategies were selected based on the effectiveness of BMPs to treat identified pollutants of concern from proposed land uses within that sub-basin. The selected water quality treatment strategies would achieve reductions of non-point source pollutants to meet the same water quality requirements as identified under Alternative A in Section 4.1.2.2 of this SEIS. In addition, DON would develop and implement a "LID BMP O&M Inspection Checklist" consistent with the 2006 CNMI Guam Stormwater Management Manual to monitor and ensure the effectiveness of LID features during operation. Any deficiencies would be reported to and addressed by the future Public Works Department of the Marine Corps Base Guam.

The final Grading/Drainage/LID Study, dated July 2013, would be provided to the design team for guidance and implementation during design and construction. The designs performed by these contractors would be subject to review by DoD professionals and technical consultants to ensure proper implementation both during design and verification during construction.

Surface Water

Surface waters within the proposed construction areas under Alternative D are limited to wetlands (see *Wetlands* section below for discussion of wetlands). Potential indirect effects to wetland areas from stormwater runoff would be minimized through implementation of an appropriate and comprehensive stormwater management plan utilizing a LID approach and other stormwater runoff protection measures and there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event. Therefore, operations associated with Alternative D would result in less than significant long-term, indirect impacts to surface waters.

Groundwater

Under Alternative D, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would also serve to protect groundwater quality and recharge. Specifically, implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that the stormwater runoff flowing into infiltration basins and recharging the aquifer would be of acceptable quality.

There would be substantially less removal of primary and secondary limestone forest, as compared to Alternative A (i.e., approximately 170 acres [70 ha] for Alternative D vs. 1,000 acres [400 ha] for Alternative A), but more area would be converted to impervious area (i.e., approximately 319 acres [129 ha] for Alternative D vs. 273 acres [110 ha] for Alternative A). Similar to Alternative A, these changes in land cover and impervious area under Alternative D would also result in minor changes to groundwater recharge rates. However, these changes in land cover and impervious area were accounted for during the development of a conceptual level of design for grading, drainage, and LID measures, and projected changes in recharge rates would be managed through updating the USGS numerical groundwater model to determine modifications to groundwater pumping, as described under Alternative A. Increased groundwater withdrawal would also be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be short-term, localized significant impacts to the affected basin within the NGLA but less than significant impacts to the overall NGLA. Potential mitigations would be the same as described for Alternative A in Section 4.1.2.2 of this SEIS.

Given stormwater runoff protection measures (i.e., implementation of LID and pollution prevention plans); implementation of water conservation measures; groundwater demand from the NGLA that would be substantially less than the sustainable yield; improved management of the NGLA through use of the numerical groundwater model; DoD assistance in identifying funding through the EAC process for an updated and expanded monitoring network; and other potential mitigation measures discussed above, operations associated with Alternative D would result in less than significant impacts to the overall NGLA and short-term, localized significant but mitigable impacts to the affected basin within the NGLA.

Nearshore Waters

Under Alternative D, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would ensure that there would be no increase in off-site transport of stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event. In addition, the distance of the project area from nearshore waters (i.e., 0.5 mile [0.8 km]) would ensure stormwater runoff, sediment, or other pollutants would not discharge to nearshore waters. Therefore, there would be no impacts to nearshore waters from stormwater runoff associated with increased impervious areas under Alternative D.

Water resources would be impacted by the increased wastewater discharge from the Northern District WWTP and Agaña WWTP during the operation of cantonment/family housing under Alternative D. The associated potential impacts would be similar to those described above in the discussion of Alternative D construction impacts to nearshore waters. However, upgrades to bring the Northern District WWTP and Agaña WWTP into compliance with the permits are expected to be completed early in the operational phase of the proposed action and such upgrades would mitigate the impact to a less than significant level. Refer to construction impacts above for a detailed discussion of WWTP discharge impacts and mitigation.

Wetlands

Under Alternative D, proposed operations at Barrigada have the potential to cause indirect effects to nearby down-gradient wetland areas, as several of the wetland areas would receive stormwater runoff/overflow from the adjacent proposed detention/retention ponds during certain storm events. However, the stormwater runoff protection measures identified above would also protect water quality entering wetlands. Specifically, implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that the stormwater runoff flowing into wetlands would be of acceptable quality. Given stormwater runoff protection measures (i.e., implementation of LID and pollution prevention plans), operations associated with Alternative D would result in less than significant indirect, long-term impacts to wetlands.

4.4.3 Air Quality

4.4.3.1 Affected Environment

Ambient air quality conditions around Barrigada are affected primarily by mobile source emissions associated with the military operations at the base and aircraft operations at Guam International Airport. Highway traffic along Routes 8, 10, 15, and 18 also contribute mobile source emissions in the area. Sensitive populations near the site are mostly located along major traffic routes.

4.4.3.2 Environmental Consequences

Construction

The construction phase annual emissions were predicted for Alternative D and are summarized in Table 4.4.3-1. Annual direct emissions would be well below the significance criterion of 250 tpy, as shown in Table 4.4.3-1. The CO_2 emissions during construction period would be less than those analyzed in the 2010 Final EIS resulting in less GHG impacts as compared to the No-Action Alternative.

Table 4.4.3-1. Barrigada Cantonment/Family Housing Annual Construction Emissions (2016-2022)

Construction	***Pollutant (tpy)***						
Year	***SO_2***	***CO***	***PM_{10}***	***$PM_{2.5}$***	***NO_x***	***VOC***	***CO_2***
2016	neg	neg	neg	neg	neg	neg	neg
2017	0.0	1.3	0.1	0.1	1.0	0.1	228.3
2018	0.3	18.6	1.1	1.0	14.4	1.9	3192.9
2019	0.6	34.7	2.1	1.9	26.8	3.6	5939.2
2020	0.2	11.1	0.7	0.6	8.6	1.1	1893.7
2021	0.7	41.4	2.5	2.2	32.1	4.3	7096.1
2022	0.3	19.0	1.2	1.0	14.7	2.0	3256.4

Legend: SO_2 = sulfur dioxide; CO = carbon monoxide; PM_{10} = particulate matter (<10 microns); $PM_{2.5}$= particulate matter (<2.5 microns); NO_x= nitrogen oxides; VOC= volatile organic compounds; CO_2 = carbon dioxide; neg = negligible.

Under Alternative D, the maximum on-site annual PM emission levels predicted and summarized in Table 4.3.3-1 are slightly less than under Alternative A (see Table 4.1.3-2) (i.e., 2.5 tpy as compared to 2.8 tpy for PM_{10} under Alternative A). Therefore, the on-site hot-spot short-term PM impacts around construction sites would be less than or similar to those under Alternative A as shown in Table 4.1.3-3.

Off-Site On-Road Vehicle Hot-Spot Analysis for CO, PM, and MSATs

Off-site on-road vehicle CO, PM, and MSATs hot-spot impact concentrations for Alternative D would be similar to those predicted for Alternative A (Section 4.1.3.2) at the analyzed intersections. This comparison is based on review of similar truck routes, as well as level of truck volumes anticipated during the construction period, under both this alternative and Alternative A. Since the concentration levels predicted under Alternative A, shown in Tables 4.1.3-3 and 4.1.3-4, for PM and CO are well below their respective NAAQS; the hot-spot concentration levels under Alternative D, similar to Alternative A, would be well below the NAAQS, resulting in less than significant short-term PM and CO impacts.

For the same above reason, off-site on-road vehicle MSATs concentration levels would be similar to those predicted under Alternative A, as shown in Tables 4.1.3-6 and 4.1.3-7, with the comparison of cancer and non-cancer risks. Therefore, the project impacts of all carcinogenic and non-carcinogenic MSATs are considered acceptable. Based on these findings, short-term construction phase air quality impacts under Alternative D are considered less than significant.

Operation

As explained in Section 3.3.3; during operational years, Alternative D would result in the worst-case off-site on-road vehicle miles travelled and would, therefore, generate the worst-case vehicular emissions. The hot-spot impact analyses of off-site on-road vehicle CO, PM, and MSATs emissions during operational years were conducted using the same methods described for Alternative A (Section 4.1.3).

Off-Site On-Road Vehicle Hot-Spot Analysis for PM

As described in Section 4.1.3 and shown in Table 4.1.3-5, the future worst-case construction year annual average daily traffic of the roadways within the study area are well below the USEPA defined screening threshold of 125,000 annual average daily traffic and 8% diesel truck traffic, which equates to 10,000 trucks. Therefore, a further hot-spot dispersion modeling analysis is not warranted and there would be no PM hot-spot concerns along the affected roadway network.

Off-Site On-Road Vehicle Hot-Spot Analysis for CO

Table 4.4.3-2 shows the total concentrations for CO in comparison to the respective NAAQS. The predicted levels are well below the NAAQS, resulting in less than significant long-term CO impacts.

Table 4.4.3-2. Alternative D Predicted Worst-Case CO Concentrations (ppm)

Site #	*Site Description*	*Operation*	
		1-hour	*8-hour*
1	Route 3/9/Chalan Santa Anita	2.2	2.1
2	Route 1 / Route 3	3.4	3.0
3	Route 16 / Route 27	3.0	2.7
4	Route 1 / Route 14A	3.6	3.1
5	Route 10 / Route 15	3.2	2.8
6	Route 1 / Route 2A	3.0	2.4

Notes: 1-hour NAAQS = 35 ppm and 8-hour NAAQS = 9 ppm.
Source: GDPW 2013.

Off-Site On-Road Vehicle Hot-Spot Analysis for MSATs

MSATs concentration levels predicted under Alternative D are shown in Table 4.4.3-3. Maximum estimated increases in cancer risk at any of the receptors due to the project are all less than the threshold criterion of 10 in a million. Therefore, the direct, long-term project impacts of all carcinogenic MSATs are considered acceptable.

The maximum chronic hazard index at any of the receptors due to project emissions are well below the target limit of 1, as shown in Table 4.4.3-4. Therefore, the direct, long-term project impacts of all non-carcinogenic MSATs are considered acceptable.

Table 4.4.3-3. Alternative D Estimated Project Operation Related Impacts Compared to Target Cancer Risk Threshold

	30-Year Estimated Cancer Risk Increase ($x10^{-6}$)	***70-Year Estimated Cancer Risk Increase ($x10^{-6}$)***	***Target Cancer Risk Threshold***
Sensitive Receptors			
Route 3/9/Chalan Santa Anita	0.000	0.001	10^{1}
Route 1 / Route 3	0.004	0.010	
Route 16 / Route 27	0.020	0.049	
Route 1 / Route 14A	0.002	0.006	
Route 10 / Route 15	0.045	0.107	
Route 1 / Route 2A	0.006	0.014	
Sidewalk Receptors			
Route 3/9/Chalan Santa Anita	0.004	0.009	10^{1}
Route 1 / Route 3	0.010	0.024	
Route 16 / Route 27	0.022	0.053	
Route 1 / Route 14A	0.008	0.020	
Route 10 / Route 15	0.146	0.350	
Route 1 / Route 2A	0.012	0.029	

Note: [1] Target threshold is 10 excess cancer cases in a million.
Source: GDPW 2013.

Table 4.4.3-4. Alternative D Estimated Project Operation Related Impacts Compared to Target Hazard Index

	30-Year Estimated Cancer Risk Increase ($x10^{-6}$)	***70-Year Estimated Cancer Risk Increase ($x10^{-6}$)***	***Target Cancer Risk Threshold***
Route 3/9/Chalan Santa Anita	0.000	0.000	1^{1}
Route 1 / Route 3	0.001	0.002	
Route 16 / Route 27	0.004	0.004	
Route 1 / Route 14A	0.000	0.002	
Route 10 / Route 15	0.008	0.022	
Route 1 / Route 2A	0.001	0.003	

Note: [1] Target hazard index indicates that exposure is below concentrations associated with adverse effects.
Source: GDPW 2013.

4.4.4 Noise

4.4.4.1 Affected Environment

Barrigada is located in an area where aircraft operating out of either AAFB or Guam International Airport generate noise contours below 60 dB and are not a factor for baseline conditions. Traffic noise along Routes 8, 10, 15, and 16 dominates the noise environment near Barrigada. Available noise data near Barrigada were collected at 156 Adacao (near the intersection of Route 8 and 10A) and 101 Route 16 with long-term noise levels of 64 dB and 65 dB, respectively.

4.4.4.2 Environmental Consequences

Construction

Construction of the cantonment area would occur in the southwest portion of federally owned lands at Barrigada. Off-base frontage would be Route 15 to the south and would provide access to Barrigada with a commercial gate and the main gate. Bachelor's quarters and parking, the commercial and main gates, open space, and an area reserved for future development would be located on-base. From south to north along the west side of Barrigada would be the commercial gate and associated structures, a collector road and operations.

Family housing would be located in the northern part of Barrigada and the closest house would be set back several hundred feet from the northern boundary line. Construction noise impacts would be primarily due to development of the cantonment area along the western boundary.

Approximately 25 residences are located adjacent to the boundary along the west side of Barrigada and about 14 residences along Route 15 with 92 and 51 people, respectively (based on average household size estimates for Guam). The construction area closest to off-base receptors would be the cantonment operations area and would be approximately 150 feet (46 m) to 200 feet (61 m) from construction activities. As discussed in Section 4.3.4, 10 pieces of heavy machinery operating simultaneously this close to a receptor is virtually impossible from a spatial point of view. Similar to Alternative C construction assumptions, it is assumed that five pieces of heavy equipment operating at 150 feet (46 m) and five operating at 200 feet (61 m) would be used. Under this scenario, short-term noise levels would be at 74.8 dBA L_{eq}, just below the USEPA threshold guideline of 75 dBA L_{eq}. However, similar to all cantonment/family housing alternatives, the construction schedule for these Roadmap Adjustments would be spread out. Sequencing work tasks and allowing only one or two pieces of heavy equipment operating in areas close to the nearest receptors would lessen the noise impacts. If only the two loudest pieces of equipment, a grader and a scraper, operated at 150 feet (46 m) and 200 feet (61 m) respectively, noise levels would be 69.4 dBA L_{eq}. Approximately 25 homes housing about 92 people would be affected by the cantonment construction. As cantonment/family housing construction noise would be below the 75 dBA USEPA construction threshold guideline, short-term noise impacts would be less than significant.

Long-term construction noise impacts consider noise generated throughout the entire duration of construction. Under this alternative, the following three different locations are analyzed: from a residential perspective; from the center of the cantonment area; and from the center of the family housing area. The cantonment area would be spread out more under this alternative compared to Alternatives A, B, and C. From the perspective of an individual receptor along the western and southern boundary of Barrigada, noise levels above 65 dB would be considered incompatible for long-term land-use noise exposure. Given the equipment list previously estimated in Alternative A, construction would need to be with 525 feet (160 m) to generate noise levels above the 65 dBA FICUN. This level is also considered the limit for annoyance. This distance comprises an insignificant percentage (<1%) of the total construction

area and should actually be considered short-term noise exposure because could not possibly last at that level for the entire 10-year period. Therefore, from this perspective, long-term noise from construction within the 525 foot (160 m) zone would be less than significant.

The cantonment area closest to receptors would be located approximately 1,000 feet (305 m) from the western edge of the Barrigada boundary. Long-term noise from of the cantonment facilities would generate noise levels of approximately 62.4 dBA. Therefore, long-term noise levels due to cantonment construction would be less than significant.

The center of the family housing would be approximately 2,000 feet (610 m) from the northern boundary of Barrigada and long-term noise levels would be about 56 dBA and well less than the FICUN criteria. Consequently, short-term and long-term construction noise impacts would be less than significant for Alternative D.

Construction activities common to all alternatives include off-site utilities and school expansions. Impacts due to these common construction projects would be as described in Section 4.1.4.2.

Operation

Upon full build-up after construction has been completed, the steady-state noise generating activities at Barrigada would be primarily due to traffic noise. Traffic noise around Barrigada would be near the proposed Main Gate on Route 15 and the Residential Gate on Route 16. The noise experienced by most noise receptors identified in the 2010 Final EIS (Volume 6, Chapter 8: Noise, Section 8.6.6.2, pages 8-49 to 8-51) affected by noise levels above 66 dB could be reduced to below 66 dB and compliant with the GDPW transportation standards because there would be nearly 50% reduction in traffic increases compared to the traffic levels described in the 2010 Final EIS. Potential noise mitigation improvement, such as sound walls, would be constructed in accordance with measures described in the 2010 Final EIS, reducing noise impacts in areas that are reasonable and technically feasible. Consequently, noise impacts due to cantonment/family housing operations and traffic at Barrigada would be less than significant.

4.4.5 Airspace

4.4.5.1 Affected Environment

Operations and functions under Alternative D consist of support, maintenance/storage, housing, and non-live fire training functions (see Section 2.2.1 in Chapter 2 of this SEIS). There would be no construction or operation activities requiring changes to airspace. Therefore, the affected environment for airspace is only discussed in the context of the LFTRC components of the proposed action (see Chapter 5).

4.4.5.2 Environmental Consequences

As discussed above, there would be no construction or operation activities requiring changes to airspace. Therefore, there would be no impact on airspace from this component of the proposed action.

4.4.6 Land and Submerged Land Use

4.4.6.1 Affected Environment

The affected environment for land use under Alternative D is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.1.3.2: Affected Environment, pages 8-34 to 8-35), and is summarized below for reference. The closure of the Nimitz Golf Course is the primary change in the affected environment subsequent to the 2010 Final EIS.

Figure 4.4.6-1 shows the land use associated with the Barrigada area and the surrounding land use classifications on an aerial image. Barrigada is federally owned and there are no submerged lands associated with it.

In summary, the DON uses the northern portion of Barrigada as a high frequency transmitter station. The transmitters generate an EMR arc that extends into the community. Guam Army National Guard also has facilities in this northern area near the site entrance off Route 8. An Army Reserve Battalion headquarters building is adjacent to the Guam Army National Guard facilities. Urban warfare training occurs in abandoned buildings. In addition, there are water wells and associated clearance zones (Figure 4.4.6-1).

The southern portion of Barrigada has a Next Generations Radar weather antenna in the center. The narrow strip of land connecting the northern and southern portions of Barrigada was the former Nimitz Golf Course (Figure 4.4.6-1), but the facilities are no longer in use.

The Barrigada area is generally bordered by residential neighborhoods and vacant (i.e., no modern manmade structures) land. Guam International Airport (i.e., A.B. Won Pat International Airport) is northwest, but not adjacent to the parcel. The land use plan designation for the adjacent surrounding land is Very Low Density Residential or Residential, except for an area of Commercial use at the northwest corner of Barrigada and a small area of Village Center at the northeast (Figure 4.4.6-1).

4.4.6.2 Environmental Consequences

The land use impacts are addressed in this section. Land ownership impacts are addressed in Section 4.4.15, Socioeconomics and General Services.

Construction

As previously discussed in Section 3.6.3.1, Methodology, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource under any of the alternatives.

Operation

All cantonment alternatives require water well development on AAFB. The affected environment and environmental consequences are described in Section 4.3.6. The proposed expansion of existing education facilities and the off-base utilities common to all alternatives are as described under Section 4.1.6. The off-base utility improvements specific to this alternative are aligned along Routes 3, 8 and 16. No land acquisition would be required for the utilities. No land use impacts would be associated with the education. However, additional inter-base IT/COMM connectivity would be required as described in Chapter 2. This includes the connection between AAFB and the existing Tata cable landing facility in southern Guam, which would require new rights of way along some southern roads and the access road to the Tata facility.

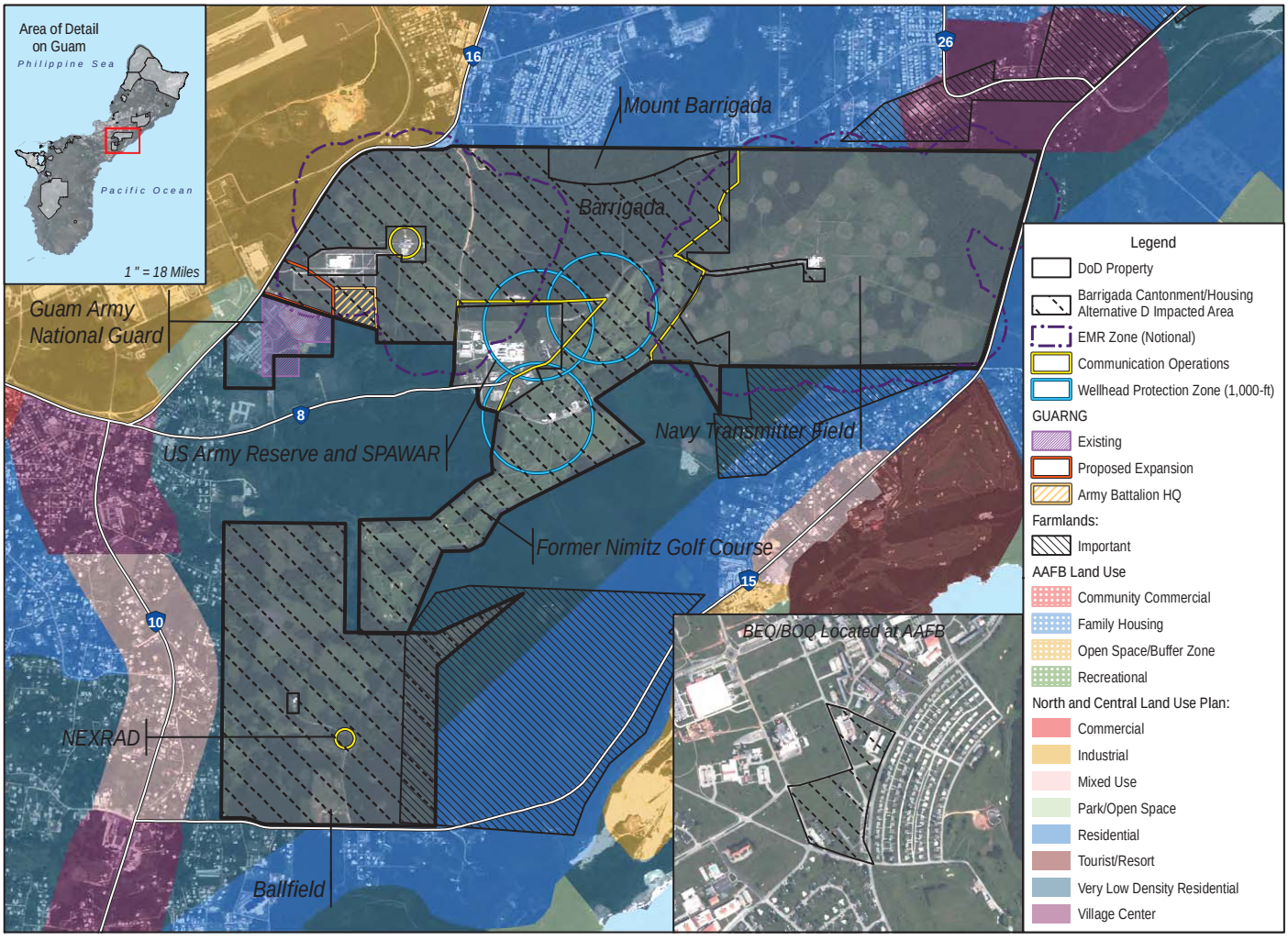


Figure 4.4.6-1
Land Use in the Vicinity of Barrigada Cantonment/Housing Alternative D

The proposed development would not impact submerged lands.

The proposed development would be compatible with existing mission critical uses and land use constraints. However, the antenna maintenance facility would be relocated. There would be a loss of open space and an increase in development density throughout Barrigada. The maximum height of the cantonment buildings would be six stories and the housing would be a maximum of two stories. Open space is incorporated in the design but there would be less open space than currently exists at the parcel, resulting in a less than significant long-term impact on the community adjacent to the base.

Eagle Field, a sports field currently accessible and used by the public, is located at the southern end of the Barrigada site near Route 15. The use of this field would be precluded by Alternative D; however, the ballfield is on DoD land, is not a unique resource, and the access is periodically renegotiated; however, there are impacts to recreational resources, as described in Section 4.4.7.

The proposed cantonment is compatible with adjacent off-base existing residential and industrial (Guam International Airport) land uses to the north and west of Barrigada. The proposed family housing would be compatible with the planned residential and very low density areas adjacent to the former golf course and southern portion of Barrigada (Figure 4.4.6-1).

Since Alternative D does not have any significant impacts to land use resources, it would have less of an impact than Alternative B.

4.4.7 Recreational Resources

4.4.7.1 Affected Environment

The primary recreational resource at Alternative D was the Nimitz Golf Course, a championship 18-hole golf course that closed permanently in January 2013 (see 2010 Final EIS Volume 2, Chapter 9: Recreational Resources, Section 9.1.3.2: Affected Environment, pages 9-6 and 9-8). Nimitz Golf Course was open to both military members and civilians and occupied the Navy Barrigada portion of the Barrigada site. Eagle Field, a sports field currently accessible and used by the public, is located at the southern end of the Barrigada site near Route 15. There is currently a formalized agreement between the Air Force and the Mayor of Mangilao for use of this field by the public. As of October 2013, the Air Force and the Mayor of Mangilao are in the process of renewing this agreement, so execution of this renewal has not yet occurred.

4.4.7.2 Environmental Consequences

Construction

With regard to construction activities, the short-term increase of construction-related vehicles on roads may cause delays to persons accessing recreational areas. Although staged construction equipment would not obstruct access to and the use of the recreational resources, inconvenience to resource seekers (e.g., potential direct impacts from detours, longer waits, and other similar nuisances) would result. Therefore, less than significant short-term impacts to recreational resources would be anticipated.

Operation

Overall recreational resource impacts would be less than those anticipated in the 2010 Final EIS due to the significantly reduced number of Marines and dependents coming to Guam. The Eagle Field would be removed as part of the base development under Alternative D and the public would no longer have access to this facility. Currently, the intensity and frequency of use at this sports field has not been verified but appears to be used quite frequently by the public for football and softball games, as well as festivals. This

9.2-acre (3.7 ha) site is easily accessible from Route 15 and Route 10 and is centrally located on the island near population centers. However, the field is located on federal property and is not formally recognized as a part of the Guam park system. Based on aerial maps of the area and a review of the 2006 Guam Comprehensive Outdoor Recreation Plan Update, there is a GDPR sports playing field located approximately 0.25 mile (0.4 km) to the west of the Barrigada site, as well as numerous playing fields near the Mangilao Community Center at the southeast corner of the intersection of Route 15 and Route 10, less than 1 mile (1.6 km) from the Barrigada site. These alternate sports field locations are in close proximity. However, the direct impacts from removal of Eagle Field from public use could result in a long-term significant impact to recreational resources in central Guam because Eagle Field is a primary location for youth and adult sports programs. Potential mitigation measures have not been identified at this time.

4.4.8 Terrestrial Biological Resources

4.4.8.1 Affected Environment

See Section 4.1.8.1 for a description of the affected environment for the AAFB support areas. The following is a discussion of only Barrigada.

Vegetation Communities

Based on 2012 surveys conducted on Barrigada, the mapped vegetation communities on portions of Barrigada was modified from the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.4.3: Navy Barrigada and Air Force Barrigada, page 10-59) (NAVFAC Pacific 2013a). In the portion of northern Barrigada surveyed in 2012, limestone forest was remapped as secondary limestone forest based on the degraded conditions of the forest documented during the survey (Figure 4.4.8-1). In southern Barrigada, large plots of land were characterized in the 2010 Final EIS as developed because of the presence of agricultural fields and other open areas and to correspond with USFS (2006) mapping. However, 2012 surveys found that most of these areas were no longer being used and scrub and other weedy vegetation was predominant. Therefore, these areas were remapped as mixed herbaceous-scrub (NAVFAC Pacific 2013a).

Terrestrial Conservation Areas

The Barrigada area does not contain any designated terrestrial conservation areas.

Wildlife - Native Species

Use of forested or grassland at Barrigada by native bird species is minimal, as described in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.4.3: Navy Barrigada and Air Force Barrigada, page 10-59). During surveys in December 2012, several migratory birds were seen using a small ephemeral pond with open water along the southwestern border: yellow bittern, little egret, and black-winged stilt. Native reptiles observed in 2012 field studies were blue-tailed skink and mourning gecko (NAVFAC Pacific 2013a).

During 2012 field surveys, non-native feral pigs were heard and heavy damage was observed in the north-central and southern forested areas of Barrigada (NAVFAC Pacific 2013a). The small wetlands present within the southwestern border of Barrigada had light to moderate feral pig damage. Additional information regarding non-native wildlife species at Barrigada is provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.4.3: Navy Barrigada and Air Force Barrigada, page 10-59).

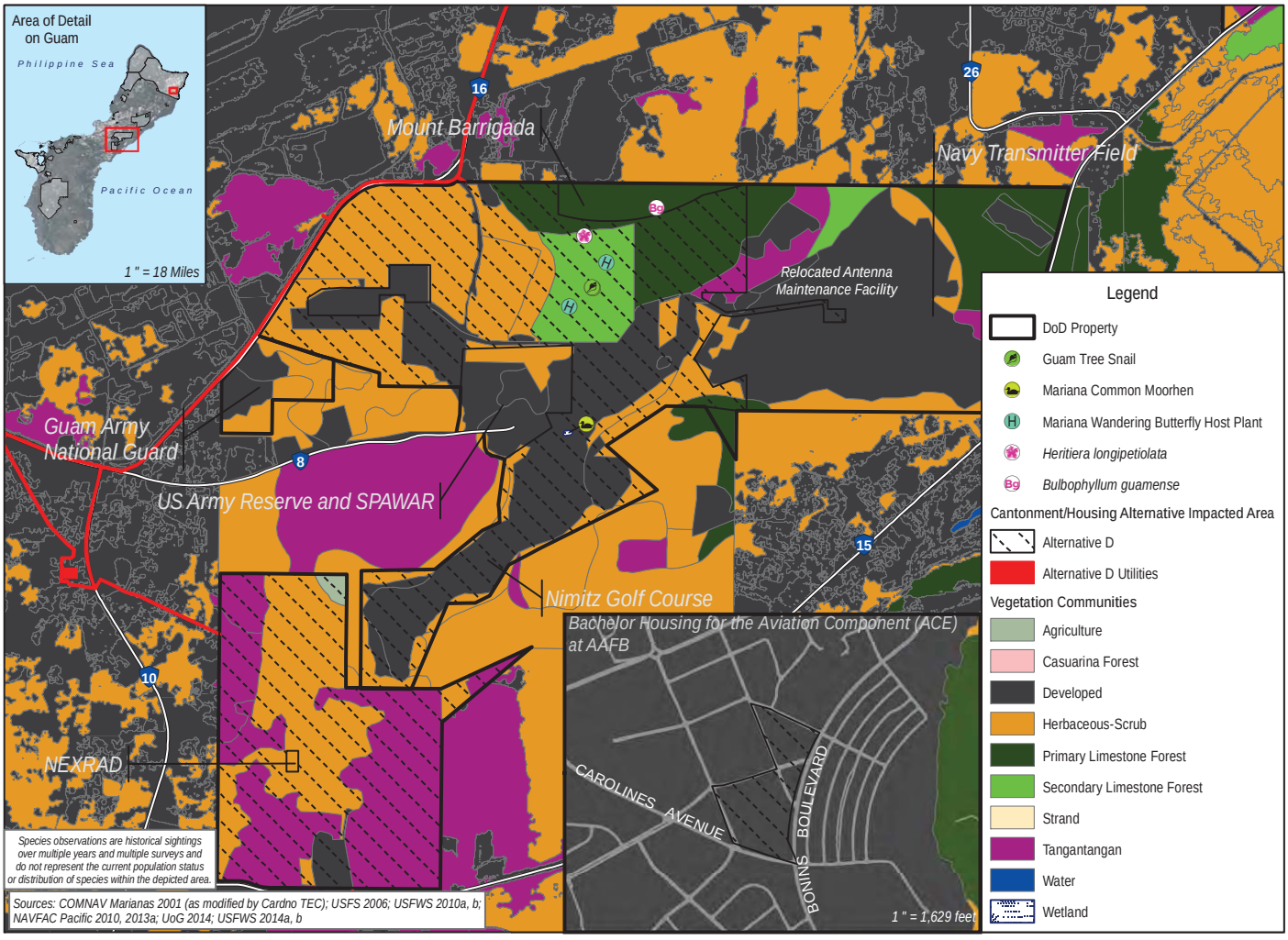


Figure 4.4.8-1
Vegetation Communities and Special-Status Species Observations - Barrigada Cantonment/Housing Alternative

Special-Status Species: Federal ESA-Listed and Proposed Species

One federal ESA-listed species (Mariana common moorhen) occurs at Barrigada (Table 4.4.8-1 and Figure 4.4.8-1). Although "suitable habitat" for special-status species is present within the Alternative D project areas, the brown treesnake, the primary factor in the extirpation of special-status wildlife species on Guam and one of the largest obstacles to achieving recovery of special-status species, is still considered abundant and widespread on Guam. Until brown treesnakes are suppressed or removed from at least targeted areas on Guam, the habitat is not in a suitable condition to support the survival of special-status species due to current snake abundance on Guam (e.g., Guam Micronesian kingfisher, Guam rail, Mariana crow) (USFWS 2010a).

Table 4.4.8-1. Distribution of Special-Status Species at Barrigada under Alternative D

Common Name	*Status**		*Habitat*	*Known to Occur*†*	*Comments*†*
	ESA	*Guam*			
Mammals					
Mariana fruit bat[a, b, c, e, f, h, t]	T	E	Limestone and coastal forests, coconut plantations.	Bar: No	Historical reports of individual bat flyovers through 1999 and a roosting colony on Mount Barrigada; recovery habitat not present.
				AAFB: Yes	Occasional sightings; recovery habitat present.
Birds					
Mariana common moorhen[c, f, g, h]	E	E	Freshwater wetlands.	Bar: Yes	Observed in golf course ponds in 2008.
				AAFB: No	NR; suitable habitat not present.
Mariana crow[i, t]	E	E	All forests with a preference for native limestone forest.	Bar: No	Extirpated from Guam - last seen on AAFB in 2012; recovery habitat present on AAFB, not on Barrigada.
				AAFB: No	
Guam rail[f, k, t]	E	E	Secondary habitats, some use of savanna and limestone forests.	Bar: No	Extirpated from the wild on Guam by 1985; recovery habitat present on AAFB and Barrigada.
				AAFB: No	
Guam Micronesian kingfisher[f, j, t]	E	E	Forest and scrub with a preference for native limestone forest.	Bar: No	Extirpated from the wild on Guam by 1988; recovery habitat present on AAFB, not on Barrigada.
				AAFB: No	
Micronesian starling[b, c, d, f, h]	-	E	All habitats but higher density in forests.	Bar: No	NR.
				AAFB: Yes	Present in the AAFB housing area and occasionally observed throughout AAFB.
White-throated ground dove[d, h, m]	-	E	Prefers native limestone and ravine forests	Bar: No	NR.
				AAFB: No	Rare observations within MSA.
Reptiles					
Slevin's skink[u]	PE	E	Mid-elevation closed humid and montane forests.	Bar: No AAFB: No	NR during 2008 and 2012 surveys; has not been recorded on Guam since 1945 and is believed to be extirpated from Guam.
Moth skink[f, g, h, n]	-	E	Large tree trunks with loose bark in forested areas.	Bar: No	NR; not observed in 2008 and 2012 surveys.
				AAFB: Yes	Reported at one location in support area.
Pacific slender-toed gecko[f, g, h, n]	-	E	Primarily ground dwelling, mainly observed in rocky areas in forests.	Bar: No	NR; not observed in 2008 and 2012 surveys.
				AAFB: No	Observed in HMU.

Table 4.4.8-1. Distribution of Special-Status Species at Barrigada under Alternative D

Common Name	*Status**		*Habitat*	*Known to Occur*†*	*Comments*†*
	ESA	*Guam*			
Invertebrates					
Guam tree snail[b, c, f, h, o, p, u]	PE	E	Cool shaded forested areas with high humidity.	Bar: No	Observed during 2008 surveys; NR during 2013 surveys.
				AAFB: No	NR during 2013 surveys.
Humped tree snail[c, f, h, p, q, u]	PE	E		Bar: No	NR during 2013 surveys.
Fragile tree snail[c, f, h, p, r, u]	PE	E		AAFB: No	
Mariana wandering butterfly[p, s, u]	PE	-	Larvae feed on one known host plant species found in native limestone forest habitat.	Bar: No AAFB: No	Has not been seen on Guam since 1979 and considered extirpated; host plants observed within impacted areas of Barrigada.
Plants					
Serianthes tree[f, g, h, n, t]	E	E	Limestone and ravine forests.	Bar: No AAFB: No	NR during 2010 and 2012 surveys; recovery habitat present on AAFB, not on Barrigada.
Tabernaemontana rotensis[f, g, h, n, u]	PT	SOGCN	Limestone forest.	Bar: No AAFB: No	NR during 2010 and 2012 surveys.
Heritiera tree[a, g, d, h, n, u]	PE	E	Limestone cliffs and plateaus.	Bar: No AAFB: No	NR during 2010 and 2012 surveys.
Cycas micronesica[g, n, u]	PT	SOGCN	Limestone forest, ravine forest, and savanna summits.	Bar: No AAFB: No	NR during 2010 and 2012 surveys.
Bulbophyllum guamense[g, n, u]	PE	-	Lowland/limestone forests.	Bar: No AAFB: No	NR during 2010 and 2012 surveys.
Eugenia bryanii[g, n, u]	PE	-	Windy exposed coastal clifflines in lowland/ limestone forests.	Bar: No AAFB: No	NR during 2010 and 2012 surveys.
Maesa walkeri[g, n, u]	PE	-	Lowland/limestone forests.	Bar: No AAFB: No	NR during 2010 and 2012 surveys.
Nervilia jacksoniae[g, n, u]	PE	-	Lowland/limestone forests.	Bar: No AAFB: No	NR during 2010 and 2012 surveys.
Psychotria malaspinae[g, n, u]	PE	-	Lowland/limestone forests.	Bar: No AAFB: No	NR during 2010 and 2012 surveys.
Solanum guamense[g, n, u]	PE	-	Lowland/limestone forests.	Bar: No AAFB: No	NR during 2010 and 2012 surveys.
Tinospora homosepala[g, n, u]	PE	-	Lowland/limestone forests.	Bar: No AAFB: No	NR during 2010 and 2012 surveys.

Legend: *Bar = Barrigada, E = endangered, NR = not reported, PE = proposed endangered, PT = proposed threatened, T = threatened. †Occurrence within Barrigada, Support Areas (south-central AAFB and Adjacent), or BEQ/BOQ Housing at AAFB.

Sources: [a]Wiles 1987; [b]Wiles *et al.* 1995; [c]COMNAV Marianas 2001; [d]GDAWR 2006; [e]Personal Communication via email regarding historical locations of fruit bats on Guam from J. Quitugua, Biologist, GDAWR to G. Metzler, TEC Inc., September 21, 2009; [f]GovGuam 2009; [g]NAVFAC Pacific 2010; [h]JRM 2013; [i]USFWS 2005; [j]USFWS 2008; [k]USFWS 2009b, BirdLife International 2013; [l]USFWS 2013; [m]NAVFAC Marianas 2013b; [n]NAVFAC Pacific 2013a, 2013b; [o]USFWS 2012a; [p]UoG 2014 [q]USFWS 2012b; [r]USFWS 2012c; [s]USFWS 2012e; [t]USFWS 2010b, [u]USFWS 2014a, 2014b.

A summary for each species is provided below. Utility corridors and other support areas required for this Alternative D are the same as required for Alternative 1 described in Section 4.1.8.

MARIANA FRUIT BAT. Mariana fruit bat population estimates on Guam in 2006 indicated fewer than 100 individuals (Janeke 2006). In 2009, the number of fruit bats on Guam was estimated to be less than 50 individuals (USFWS 2009a). Extensive surveys conducted throughout AAFB between December 2010 and December 2011 resulted in a conservative estimate of approximately 25 fruit bats (JRM *et al.* 2012a). Only 50 detections of individual bats were recorded during 84 station count surveys from March through September 2012, and no active fruit bat aggregation or colony site was discovered (JRM *et al.* 2012b). It is likely that a small number of solitary-roosting fruit bats (<10) also occur on Navy lands. Solitary individuals can move to and from areas during the year. The majority of fruit bats remaining on Guam likely reside on AAFB.

Recent fruit bat observations were of single flying individuals and (in a few cases) roosting and were most commonly observed in three general regions on AAFB as shown in Figure 4.1.8-5: the cliffline extending from above the CATM Range east to Pati Point; in or near the MSA; and in the vicinity of the HMU (USGS brown treesnake research enclosure) (JRM *et al.* 2012a). High and medium priority fruit bat roosting habitat as defined in the AAFB *Mariana Fruit Bat Management Plan* are depicted in Figure 4.1.8-5. These areas are based on the location of historic colony roost locations on AAFB and current habitat conditions (AAFB 2008b). Fruit bats do occur within the proposed utility support areas associated with Alternative D (see Figure 4.1.8-5).

As reported in the 2010 Final EIS, daytime sightings of bats (in solitary and in small groups) were made during 1980-1999 in the Barrigada Area at Mt. Barrigada and near the Nimitz Golf Course (Personal Communication via email regarding historical locations of fruit bats on Guam from J. Quitugua, Biologist, GDAWR to G. Metzler, TEC Inc., September 21, 2009). There have been no observations of fruit bats at Barrigada since 1999. The closest known occurrence of fruit bats is on AAFB, more than 8 miles (13 km) to the north of Barrigada. While fruit bats are known to travel 6-7.5 miles (10-12 km) to reach forage areas (USFWS 1990), given the disturbed nature of the area on and surrounding Barrigada and the estimated very low numbers of fruit bats currently on Guam that are found only within AAFB and NAVMAG (13 miles [21 km] to the south), it is unlikely that fruit bats would occur within the Barrigada action area. However, fruit bat recovery habitat is found within proposed project impacted areas in support areas on AAFB and adjacent lands (see Figure 3.8.3-1). Therefore, this species is addressed only for the proposed support areas on AAFB associated with Alternative D.

MARIANA COMMON MOORHEN. Mariana common moorhens have been reported in a man-made pond at the Nimitz Golf Course (now closed) on Barrigada (see Figure 4.4.8-1) (COMNAV Marianas 2001). Although field surveys in 2012 did not include the Nimitz Golf Course, the surveys did document the presence of seven small, depressional wetlands in southern Barrigada (NAVFAC Pacific 2013b). All but one of these wetlands had either no open water or only very small pools of water along some of the low-lying margins. One wetland along the southwestern border did have a significant area of open water when visited on December 6, but by a second visit on December 17 the water had substantially receded and would likely have been dry within a few weeks (NAVFAC Pacific 2013a). Based on communications with USDA Wildlife Services, this pond is most likely man-made and the result of a proposed construction project at Barrigada that was halted over 10 years ago. It is unknown if the pond contains a substantial area of open water in all years or only in particularly wet years such as occurred in 2012. This seasonal pond could be marginal temporary habitat for the Mariana common moorhen.

The Mariana common moorhen has not been reported from AAFB (JRM 2013).

MARIANA CROW. Since 2009, the Mariana crow population on Guam consisted only of two males on AAFB, occurring primarily within the MSA (USFWS 2009c). However, as of 2012, the Mariana crow is considered extirpated in the wild on Guam (Personal communication via letter from USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, HI regarding the DON NOI for Proposed Placement of LFTRC on Guam NWR; December 7, 2012). The closest population of crows is on the island of Rota, approximately 56 miles (90 km) north of Guam. Therefore, as the crow does not occur in the wild on Guam, there would be no impacts to the crow at Barrigada with implementation of Alternative D. However, crow recovery habitat is found within proposed project impacted areas in support areas on AAFB and adjacent lands (see Figure 3.8.3-1). Therefore, this species is addressed only for the proposed support areas on AAFB associated with Alternative D.

GUAM RAIL. The Guam rail has been extirpated in the wild on Guam since 1985 and exists primarily in captivity on Guam and in mainland zoos. Experimental populations of Guam rails were introduced onto Rota, CNMI in 1989 and onto Cocos Island, off the southern coast of Guam, in 2011 (USFWS 2009b; BirdLife International 2013). The Guam rail prefers edge habitats, especially grassy or secondary vegetation areas which provide good cover; mature forest is deemed only marginal for the Guam rail (USFWS 2009b). Rail recovery habitat within the proposed impacted areas associated with Alternative D includes secondary limestone forest, herbaceous scrub, and tangantangan (see Figure 3.8.3-2).

Guam Micronesian Kingfisher. The Guam Micronesian kingfisher was extirpated in the wild by 1988 and is now found only in captivity on Guam and at mainland zoos (USFWS 2008). Kingfishers utilized a wide variety of habitats including primary and secondary limestone forest, strand forest, coconut forest, edge habitats, and forest openings, but mature forests with tree cavities suitable for nesting may be an important requirement for kingfisher reproduction (USFWS 2008). Therefore, as the kingfisher does not occur in the wild on Guam, there would be no impacts to the kingfisher at Barrigada with implementation of Alternative D. However, kingfisher recovery habitat is found within proposed project impacted areas in support areas on AAFB and adjacent lands (see Figure 3.8.3-1). Therefore, this species is addressed only for the proposed support areas on AAFB associated with Alternative D.

SLEVIN'S SKINK. Originally found on Guam, Cocos Island, Rota, Tinian, Guguan, Alamagan, Asuncion, and Maug, it is now limited to Cocos Island, Sarigan, Guguan, Alamagan, Pagan, and Asuncion. Slevin's skink has not been recorded on Guam since 1945 and is believed to be extirpated from Guam; it is now known to occur only on Cocos Island (an atoll south of Guam) (USFWS 2014a). There are no records of the species within the impacted areas of Barrigada or AAFB (USFWS 2014b). Therefore, as Slevin's skink is not found within the impacted areas of Alternative D, this species is not addressed further.

TREE SNAILS. As described in Section 10.1.4.3 of the 2010 Final EIS, the ESA proposed endangered Guam tree snail was observed at one location in secondary limestone forest in the north-central portion of Barrigada during vegetation surveys in 2008 (see Figure 4.4.8-1) (NAVFAC Pacific 2010). Surveys conducted in 2013 at Barrigada along four transects totaling 7,150 feet (2,180 m) within limestone forest did not observe any of the proposed endangered tree snail species. No tree snails have been recently recorded from the impacted areas associated with Alternative D (UoG 2014). Therefore, as tree snails are not found within the impacted areas of Alternative D, these species are not addressed further.

MARIANA WANDERING BUTTERFLY. The ESA-proposed species Mariana wandering butterfly has not been seen on Guam since 1979 and considered extirpated; a single remaining population occurs on Rota, CNMI (USFWS 2013). The only species known to be a Mariana wandering butterfly host plant (*Maytenus thompsonii*) is a common shrub of limestone forests on Guam and was observed during 2013

surveys within the impacted areas associated with Alternative D (see Figure 4.1.8-4) (Moore and McMakin 2001; UoG 2014).

SERIANTHES TREE. There are no records of the species within the impacted areas associated with Alternative D (USFWS 2014b). However, *Serianthes* recovery habitat is found within proposed project impacted areas in support areas on AAFB and adjacent lands (see Figure 3.8.3-2).

HERITIERA LONGIPETIOLATA. This endemic tree is found on AAFB in crevices of rough limestone in primary limestone forest. A 2007 study documented the species as occurring at numerous locations on AAFB, primarily in the central portion of the base, and near the limestone cliffs in the northeast and southeast corners (UoG 2007) (see Figure 4.1.8-5). There is one historical record of an individual within the northern portion of Barrigada (USFWS 2014a, 2014b); however, this species was not observed during surveys in 2010 and 2012 (NAVFAC Pacific 2010, 2013a, 2013b). Therefore, as *H. longipetiolata* is not found within the impacted areas of Alternative D, this species is not addressed further.

TABERNAEMONTANA ROTENSIS. There are no records of *T. rotensis* within the Alternative D impacted areas. The distribution of this tree species on AAFB was evaluated in 2007 and over 21,000 *T. rotensis* individuals were found throughout AAFB at 265 mapped locations, primarily in the central portion of the base and near the limestone cliffs in the northeast (see Figure 4.1.8-2) (UoG 2007). A few individuals have been recorded within the proposed utility support areas in south-central AAFB (see Figure 4.1.8-2). Therefore, as *T. rotensis* is not found within the impacted areas of Alternative D, this species is not addressed further.

CYCAS MICRONESICA. The cycad is found in limestone forests throughout Guam, including AAFB, and is proposed as an endangered species under the ESA because of the Asian cycad scale insect that is devastating the species (USFWS 2014a). This species has not been observed within the Alternative D impacted areas associated with the cantonment/family housing alternatives during past surveys (AAFB 2008b; NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014b). Therefore, as *C. micronesica* is not found within the impacted areas of Alternative D, this species is not addressed further.

BULBOPHYLLUM GUAMENSE. An epiphyte in the orchid family, this species occurs in mat-like formations on tree branches of coastal lowland/limestone forests. Currently, there are 8 known occurrences on Guam totaling fewer than 250 individuals (USFWS 2014a, 2014b). Although there is a record of this species immediately to the north of the proposed Alternative D impacted area (see Figure 4.4.8-1), there are no records of the species within the impacted area (USFWS 2014b). Therefore, as *B. guamense* is not found within the impacted areas of Alternative D, this species is not addressed further.

DENDROBIUM GUAMENSE. An epiphyte in the orchid family, this species occurs on tree branches of coastal lowland/limestone forests. Currently, there are 4 known occurrences on Guam with fewer than 250 individuals (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Barrigada or AAFB support areas (USFWS 2014b). Therefore, as *D. guamense* is not found within the impacted areas of Alternative D, this species is not addressed further.

EUGENIA BRYANII. A perennial shrub in the myrtle family, the species is known only from the island of Guam. Historically, *E. bryanii* is known from windy exposed coastal clifflines and along the Pigua River, in lowland/limestone forests. Currently, *E. bryanii* is known from 6 occurrences totaling fewer than 420 individuals (USFWS 2014a, 2014b). Only one occurrence is within the vicinity of the proposed project areas – one individual plant was observed in July 2014 to the west of the southern end of the AAFB flightline (Figure 4.1.8-5) (Personal communication from J. Farley, NAVFAC Marianas, to R. Spaulding, Cardno, regarding *Eugenia bryanii* observation at AAFB, 29 October 2014). There are no records of the

species within the impacted areas of Alternative D (USFWS 2014b). Therefore, as ***E. bryanii*** is not found within the impacted areas of Alternative D, this species is not addressed further.

MAESA WALKERI. A shrub or small tree in the primrose family typically found in limestone forests, this species is known from only 2 individuals on Guam – 1 individual on Mt. Lamlam and 1 individual on Mt. Almagosa (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative D (USFWS 2014b). Therefore, as ***M. walkeri*** is not found within the impacted areas of Alternative D, this species is not addressed further.

NERVILIA JACKSONIAE. A small herb in the orchid family, this species is found in lowland/limestone forests. On Guam, ***N. jacksoniae*** is known from 2 occurrences totaling fewer than 200 individuals: 1 is near the UoG campus and 1 is to the northwest of Tarague Beach (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative D (USFWS 2014b). Therefore, as ***N. jacksoniae*** is not found within the impacted areas of Alternative D, this species is not addressed further.

PSYCHOTRIA MALASPINAE. A shrub or small tree in the coffee family, this species is found in lowland/limestone forests. Currently, ***P. malaspinae*** is known from 5 occurrences: 1 individual at Ritidian Point within the Guam NWR, 1 individual at Pågat Point, 1 individual at the base of Mt. Almagosa, and 2 individuals at NWF (USFWS 2014a, 2014b). None of these individuals have been observed within the last 5 years. A specimen collected from the Ritidian NWR in August 2013 is currently pending identification (USFWS 2014a). There are no records of the species within the impacted areas of Alternative D (USFWS 2014b). Therefore, as ***P. malaspinae*** is not found within the impacted areas of Alternative D, this species is not addressed further.

SOLANUM GUAMENSE. A small shrub in the nightshade family that occurs within limestone forests. Currently, ***S. guamense*** is known from a single occurrence of one individual on Guam (USFWS 2014a). There are no records of the species within the impacted areas of Alternative D. Therefore, as ***S. guamense*** is not found within the impacted areas of Alternative D, this species is not addressed further.

TINOSPORA HOMOSEPALA. A vine in the moonseed family found in limestone forests. Currently, ***T. homosepala*** is known from 3 occurrences totaling approximately 300 individuals: 1 occurrence on the western side of Asan Ridge; 1 occurrence near the War in the Pacific Historical Park; and 1 occurrence on the cliff face at Hagåtña (USFWS 2014a). There are no records of the species within the impacted areas of Alternative D (USFWS 2014b). Therefore, this species is not addressed further.

TUBEROLABIUM GUAMENSE. An epiphyte in the orchid family found in limestone forests. Currently, ***T. guamense*** is known from 3 occurrences on Guam: 2 within the NAVMAG and 1 in the northeastern area of Finegayan (see Figure 4.1.8-4) (NAVFAC Pacific 2010; USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative D (USFWS 2014b). Therefore, as ***T. guamense*** is not found within the impacted areas of Alternative D, this species is not addressed further.

Special-Status Species: Guam-Listed Species and SOGCN

Two Guam-listed endangered species (moth skink and Micronesian starling) occur on support areas on AAFB and adjacent lands; none are known to occur on Barrigada (Table 4.4.8-1).

MICRONESIAN STARLING. The Micronesian starling has not been reported for Barrigada. The starling is present in the housing area at AAFB (JRM 2013; J. Savidge, Colorado State University, personal communication to G. Metzler, Cardno TEC, May 23, 2013) and has also been observed occasionally throughout AAFB (NAVFAC Pacific 2010; JRM ***et al.*** 2012d; JRM 2013) (see Figure 4.1.8-5).

WHITE-THROATED GROUND DOVE. The white-throated ground dove is reported as extirpated from Guam due to the brown treesnake (GDAWR 2006). Although occasionally seen on AAFB within the MSA, it has not been reported within the utility support areas associated with Alternative D. There are no records of the ground dove occurring at Barrigada. Therefore, as the white-throated ground dove is not found within the impacted areas of Alternative D, this species is not addressed further.

Moth Skink and Pacific Slender-toed Gecko. Although both species have been observed within AAFB, only the moth skink has been observed within proposed utility impacted areas along the southern boundary of the base (see Figure 4.1.8-5) (NAVFAC Pacific 2010). Moth skinks and slender-toed geckos have also been observed by USGS biologists within the HMU (R. Reed, USGS Brown Treesnake Project, personal communication, April 24, 2013). Based on previous surveys within proposed impacted areas on AAFB in support of the 2010 Final EIS and this SEIS (NAVFAC Pacific 2010, 2013a), there are no known occurrences of the Pacific slender-toed gecko within the Alternative D impacted areas. Proposed water well utilities would avoid the HMU where the Pacific slender-toed gecko is known to be present. Therefore, as the Pacific slender-toed gecko is not found within the impacted areas of the Alternative D, this species is not addressed further.

4.4.8.2 Environmental Consequences

Construction

Vegetation. The vegetation communities that would be impacted during proposed facility and infrastructure construction activities under Alternative D are shown in Figure 4.4.8-1 for the cantonment and housing area and in Figure 4.1.8-2 for the support areas. Approximately 99 acres (40 ha) of primary limestone forest and 133 acres (54 ha) of secondary limestone forest would be impacted during proposed construction activities at Barrigada and associated support areas (Table 4.4.8-2 and Figure 4.4.8-1). Approximately 735 acres (297 ha) of herbaceous scrub and tangantangan would also be impacted, as well as 461 acres (186 ha) of currently developed areas (Table 4.4.8-2). The wetland area of 0.3 acre (1.4 ha) is associated with the pond on the currently closed Nimitz Golf Course. Refer to Section 4.2.2.2 for the discussion of impacts to wetlands.

Table 4.4.8-2. Direct Impacts to Vegetation Communities at Barrigada and Support Areas with Implementation of Cantonment/Family Housing Alternative D

Project Component	*Vegetation Community (acres [ha])*							
	PLF	***SLF***	***HS***	***TT***	***Ag***	***Dev***	***Wet***	***Total***
Barrigada	97.0 (39.3)	69.6 (28.2)	463.8 (187.7)	254.9 (103.2)	4.8 (1.9)	277.7 (112.4)	0.3 (<0.1)	**1,168.1 (470.7)**
BEQ/BOQ housing at AAFB	0	0	0	0	0	25.7 (10.4)	0	**25.7 (10.4)**
Utility corridor specific to Alternative D	0.3 (0.1)	5.5 (2.2)	1.6 (0.6)	0.1 (<0.1)	0	82.5 (33.4)	0	**90.0 (36.4)**
Utility corridors & water well areas common to Alternatives A-E	1.2 (0.5)	57.9 (23.4)	9.5 (3.8)	4.5 (1.8)	0	57.8 (23.4)	0	**130.9 (53.0)**
High School/ Middle School Expansions	0	0	0	0.3 (0.1)	0	17.2 (7.0)	0	**17.5 (7.1)**
Total	**98.5 (39.9)**	**133.0 (53.8)**	**474.9 (192.2)**	**259.8 (105.1)**	**4.8 (1.9)**	**460.9 (186.5)**	**0.3 (<0.1)**	**1,432.2 (579.6)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; TT = tangantangan; Ag = agriculture; Dev = developed; Wet = wetland.

Native limestone forest, both primary and secondary, has been significantly reduced on Guam due to past and ongoing actions including extensive disturbance during and after WWII, widespread planting of non-native species, and impacts from non-native ungulates, development, fire, and deforestation. As stated in Section 3.8.1.1, limestone forests on Guam are important since they retain the functional ecological components of native forest that provide habitat for the majority of Guam's native species, including ESA-listed, ESA-proposed, and Guam-listed species and Guam SOGCN, as well as maintaining water quality and reducing fire risk. Non-native forest communities (e.g., tangantangan, *Vitex*) significantly alter the forest structure, composition, and resilience to other disturbance processes and do not provide the conditions suitable for native flora and fauna species to persist (Morton *et al.* 2000; GDAWR 2006; Guam Department of Agriculture 2010; JRM 2013).

Of the 18,538 acres (7,502 ha) of primary and secondary limestone forest found on Guam, approximately 13,110 acres (5,305 ha) (or 71%) are found primarily within AAFB, Finegayan, and NAVMAG (USFS 2006). Under Alternative D, approximately 99 acres (40 ha) of primary limestone forest and 133 acres (54 ha) of secondary of limestone forest would be developed, primarily within Barrigada, but also within the utility corridors common to all cantonment/family housing alternatives (Table 4.4.8-2). Therefore, given the importance of limestone forest habitat for native species and the continuing loss of limestone forest across Guam, the conversion of 231 acres (94 ha) of limestone forest on Barrigada and supporting areas under Alternative D to developed area would be a significant but mitigable impact to the regional vegetation community and its function.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on vegetation communities with implementation of Alternative D. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of Biosecurity Outreach and Education.
- *Contractor Education Program*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the contractor education program.
- *Onsite Vegetation Waste Management Procedures*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the vegetation waste management procedures.
- *DON Guam Landscaping Guidelines*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of landscaping guidelines.
- *Contractor Plans and Specifications*. All construction will occur within the limits of construction shown in the project figures. Contractors will be responsible for any unauthorized vegetation damage and will not move outside the designated construction zone.

Potential Mitigation Measures

To mitigate for significant impacts to limestone forest, the DON proposes to implement forest enhancement on a minimum of 231 acres (94 ha) of limestone forest. Forest enhancement would include but is not limited to the following actions:

- Ungulate management consisting of exclusion fencing and active control (i.e. trapping, snaring, shooting) with the goal of eradication within the fenced areas.

- Non-native, invasive vegetation removal.
- Propagation, planting, and establishment of native species that are characteristic of native limestone forest habitats (e.g., *A. mariannensis, G. mariannae, F. prolixa, M. citrifolia, W. elliptica*).

The degradation and loss of primary limestone and other forest habitats resulting from ungulate damage and invasion by alien plant species has substantially diminished the extent of habitat for native species in the Mariana archipelago. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including special-status species. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Terrestrial Conservation Areas. The cantonment and housing areas under Alternative D would not be located on Overlay Refuge lands. However, proposed utility areas common to all alternatives would impact 48 acres (20 ha) of Overlay Refuge lands (Table 4.4.8-3). This 48 acres (20 ha) is less than 1% of the total Overlay Refuge lands on Guam. Therefore, because proposed construction activities would impact a very small percentage of Overlay Refuge lands, the conversion of 48 acres (20 ha) of Overlay Refuge lands to developed areas would be a less than significant impact.

Table 4.4.8-3. Impacts to Overlay Refuge at Barrigada and Support Areas with Implementation of Cantonment/Family Housing Alternative D

Project Component	*Overlay Refuge (acres [ha])*						
	PLF	***SLF***	***HS***	***TT***	***CP***	***Dev***	***Total***
Barrigada cantonment and housing	0	0	0	0	0	0	**0**
Utility corridor specific to Alternative D	0	0	0	0	0	0	**0**
Utility corridors and water well areas common to Alternatives A-E	0	38.3 (15.5)	0	0	0	10.0 (4.0)	**48.3 (19.5)**
Total Overlay Refuge Impacted	**0**	**38.3 (15.5)**	**0**	**0**	**0**	**10.0 (4.0)**	**48.3 (19.5)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; TT = tangantangan; CP = coconut plantation; CF = *Casuarina* forest; Dev = developed.

Wildlife - Native Species. Impacts to commonly occurring wildlife on Barrigada were evaluated in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.4.2: Central, page 10-183). Based on that analysis, impacts to these common species would be less than significant.

Native bird species reported for Barrigada and support areas on AAFB are predominantly migratory shorebird species and primarily use open areas such as grassy fields. The proposed construction at Barrigada and AAFB would not reduce the amount of these open space areas. The conversion of forested areas to open areas and the proposed construction for utility corridors would result in additional open space. The loss of woody vegetation would result in the loss of nesting areas for the yellow bittern, but this loss would not result in significant adverse effects on the bittern population on Guam because suitable nesting habitat occurs throughout the island. Short-term construction noise may temporarily impact suitable habitat for some birds in the vicinity of the construction areas, but they would relocate to other open and forested areas on Barrigada and AAFB, and could return to the area following construction. Implementation of Alternative D would not have a significant adverse effect on a population of any migratory bird species or other native wildlife species. Non-listed native reptiles are abundant throughout Guam and impacts to vegetation communities under Alternative D would result in less than significant impacts to non-listed native reptile populations.

Therefore, as presented above, long-term, direct impacts to populations of native wildlife species would not result because these species are abundant in surrounding areas and could repopulate portions of suitable habitat within the affected area after construction. Therefore, direct impacts to native wildlife would be less than significant with implementation of proposed construction activities associated with Alternative D.

Proposed construction activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. To prevent the inadvertent spread of non-native species on Guam or to other locations off of Guam, the DON would implement standard biosecurity measures (e.g., HACCP, brown treesnake interdiction measures, coconut rhinoceros beetle vegetation management procedures, outreach/education, and monitoring to evaluate effectiveness of HACCP) into construction protocols, procedures, and activities.

The following BMPs would be implemented to avoid and minimize potential direct, long-term impacts of proposed construction activities on native wildlife with implementation of Alternative D.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

With implementation of these BMPs, including development of HACCP plans and ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species (e.g., coconut rhinoceros beetle), the risk of the introduction and establishment of new or spread of existing non-native species on Guam is substantially reduced. Therefore, there would be less than significant impacts to native wildlife species related to the potential introduction and establishment of non-native species with implementation of proposed construction activities associated with Alternative D.

Damage of forested areas, particularly primary and secondary limestone forests, by non-native ungulates (i.e., deer and pigs) is a serious concern on Guam. Under Alternative D, removal of large amounts of secondary limestone forest currently used by ungulates would displace and concentrate ungulates into adjacent areas, resulting in even higher densities and potentially greater habitat damage. Potential impacts from changes in ungulate densities from construction projects within the same or similar habitat areas as proposed in this SEIS were addressed in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-115).

The implementation of the potential mitigation measures under the *Vegetation* section above would also benefit native wildlife species. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. Approximately 48 acres (19 ha) of Mariana fruit bat recovery habitat would be removed due to proposed construction activities associated with utility and water well areas on AAFB under Alternative D (Table 4.4.8-4). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.4.8-4. Summary of Permanent Construction-Related Impacts to Mariana Fruit Bat Recovery Habitat with Implementation of Cantonment/Family Housing Alternative D

Project Component	*Recovery Habitat (acres [ha])*
Barrigada cantonment and housing	0
Utility corridor specific to Alternative D	0
Utility corridors and water well areas common to Alternatives A-E	48.0 (19.4)
Total Recovery Habitat Impacted	**48.0 (19.4)**

The species is currently limited to the few areas on Guam away from human activities and with suitable habitat, primarily on federal lands on the NAVMAG and AAFB (JRM *et al.* 2012a, 2012b; JRM 2013; A. Brooke, NAVFAC Marianas, personal communication). However, illegal hunting, loss and degradation of native forest, predation by the brown treesnake, and the increased extirpation risk owing to the high vulnerability of very small populations continue to limit the potential recovery of the species on Guam (USFWS 2010; JRM 2013). Based on the equilibrium/carrying capacity of snakes on Guam (Rodda and Savidge 2007), implementation of the proposed action is not expected to increase the likelihood of predation by the brown treesnake on Mariana fruit bats.

The loss of 48 acres (19 ha) of fruit bat recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, and it would not substantially reduce the total number of bats that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to the Mariana fruit bat with implementation of proposed construction activities associated with Alternative D.

The following BMPs may be implemented to avoid and reduce potential direct long-term impacts of proposed construction activities on Mariana fruit bats and recovery habitat with implementation of Alternative D.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Pre-Construction Surveys*. Surveys would be completed within suitable fruit bat habitat 1 week prior to onset of construction activities following the USFWS-approved JRM protocol. If a fruit bat is present within 492 feet (150 m) of the project site, the work must be postponed until the bat has left the area.
- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all new

roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

In addition, the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 231 acres [94 ha] of limestone forest) would provide additional benefit to bat recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana fruit bat.

MARIANA CROW. The Mariana crow is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the crow is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the crow, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative D, impacts to the crow would be limited to recovery prospects. If crows are reintroduced and exposed to construction activities associated with Alternative D, they may be disturbed (DON 2014).

Although the crow no longer occurs on Guam, approximately 48 acres (19 ha) of crow recovery habitat would be removed due to proposed construction activities associated with utility and water well areas on AAFB under Alternative D (Table 4.4.8-5). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.4.8-5. Summary of Permanent Construction-Related Impacts to Mariana Crow Recovery Habitat with Implementation of Cantonment/Family Housing Alternative D

Project Component	*Recovery Habitat (acres [ha])*
Barrigada cantonment and housing	0
Utility corridor specific to Alternative D	0
Utility corridors and water well areas common to Alternatives A-E	48.0 (19.4)
Total Recovery Habitat Impacted	**48.0 (19.4)**

This loss of recovery habitat on Guam would not preclude the recovery or survival of the crow should it be reintroduced to Guam in the future, and it would not substantially reduce the total number of crows that the island can support. This loss of recovery habitat on Guam would not preclude the recovery or survival of the crow should it be reintroduced to Guam in the future, and it would not substantially reduce the total number of crows that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to the Mariana crow with implementation of proposed construction activities associated with Alternative D. If and when the crow is reintroduced to Guam, the best available information indicates project-related noise would not further reduce the amount of recovery habitat suitable for this species' breeding, feeding and sheltering (USFWS 2010).

The following BMPs may be implemented to avoid and reduce potential direct long-term impacts of proposed construction activities on Mariana crow recovery habitat with implementation of Alternative D.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

In addition, the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 231 acres [94 ha] of limestone forest) would provide additional benefit to crow recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana crow, should it be reintroduced to Guam in the future.

GUAM RAIL. The Guam rail is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the rail is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the rail, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the rail is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative D, impacts to the rail would be limited to recovery prospects. If rails are reintroduced and exposed to construction activities under Alternative D, they may be disturbed (DON 2014).

Although the rail no longer occurs on Guam, approximately 864 acres (350 ha) of rail recovery habitat would be removed due to proposed construction activities at Barrigada and the AAFB support areas under Alternative D (Table 4.4.8-6). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.4.8-6. Summary of Permanent Construction-Related Impacts to Guam Rail Recovery Habitat with Implementation of Cantonment/Family Housing Alternative D

Project Component	*Recovery Habitat (acres [ha])*
Barrigada cantonment and housing	805.0 (325.8)
Utility corridor specific to Alternative D	16.5 (6.7)
Utility corridors and water well areas common to Alternatives A-E	42.3 (17.1)
Total Recovery Habitat Impacted	**863.8 (349.6)**

Although this loss of recovery habitat on Guam would not preclude the recovery of the rail should it be reintroduced to Guam in the future, it would reduce the total number of rails that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam rail.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the recovery of the Guam rail with implementation of Alternative D. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 231 acres [94 ha] of limestone forest) would benefit Guam rail recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam rail, should it be reintroduced to Guam in the future.

GUAM MICRONESIAN KINGFISHER. The Guam Micronesian kingfisher is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the kingfisher is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the kingfisher, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the kingfisher is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative D, impacts to the kingfisher would be limited to recovery prospects. If kingfishers are reintroduced and exposed to construction activities under Alternative D, they may be disturbed (DON 2014).

Although the kingfisher no longer occurs on Guam, approximately 48 acres (19 ha) of kingfisher recovery habitat would be removed due to proposed construction activities associated with utility and water well areas on AAFB under Alternative D (Table 4.4.8-7). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.4.8-7. Summary of Permanent Construction-Related Impacts to Guam Micronesian Kingfisher Recovery Habitat with Implementation of Cantonment/Family Housing Alternative D

Project Component	*Recovery Habitat (acres [ha])*
Barrigada cantonment and housing	0
Utility corridor specific to Alternative D	0
Utility corridors and water well areas common to Alternatives A-E	48.0 (19.4)
Total Recovery Habitat Impacted	**48.0 (19.4)**

The loss of 83 acres (34 ha) of kingfisher recovery habitat on Guam would not preclude the recovery of the kingfisher, and it would not substantially reduce the total number of kingfishers that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to the kingfisher with implementation of proposed construction activities associated with Alternative D.

The following BMPs may be implemented to avoid and reduce potential direct long-term impacts of proposed construction activities on kingfisher recovery habitat with implementation of Alternative D.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

In addition, the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 231 acres [94 ha] of limestone forest) would provide additional benefit to kingfisher recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam Micronesian kingfisher, should it be reintroduced to Guam in the future.

MARIANA COMMON MOORHEN. As noted in Section 4.4.8.1, moorhens have been observed at the Nimitz Golf Course pond, although nesting has not been recorded. The pond is probably used as a temporary resting area while transiting to other ponds throughout Guam such as those identified in the recovery plan for the species (USFWS 1991). Therefore, the loss of the one pond within Barrigada under Alternative D would be a less than significant impact to the Mariana common moorhen.

GUAM TREE SNAIL. Although the Guam tree snail was documented in the secondary limestone forest at Navy Barrigada in 2008, it was not observed during surveys in 2013 in support of this SEIS (UoG 2014). Increased degradation of the secondary limestone forest by ungulates (i.e., pigs) may have resulted in the loss of suitable tree snail habitat at Barrigada (NAVFAC Pacific 2013a; UoG 2014). Surveys have not been conducted within the primary limestone forest in the northern portion of Barrigada associated with Mount Barrigada. Therefore, the loss of 266 acres (108 ha) of primary and secondary limestone forest habitat at Barrigada would be a significant but mitigable impact to the Guam tree snail.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the Guam

tree snail with implementation of Alternative D. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The implementation of the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 231 acres [94 ha] of limestone forest) would benefit tree snail species and habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam tree snail.

SERIANTHES TREE. Although individual *Serianthes* trees do not occur within the impacted areas of Alternative D, approximately 41 acres (17 ha) of *Serianthes* recovery habitat would be removed due to proposed construction activities at the AAFB support areas (Table 4.4.8-8). See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.4.8-8. Summary of Direct Construction-Related Impacts to *Serianthes* Recovery Habitat with Implementation of Cantonment/Family Housing Alternative D

Project Component	*Recovery Habitat (acres [ha])*
Barrigada cantonment and housing	0
Utility corridor specific to Alternative D	0.4 (0.2)
Utility corridors and water well areas common to Alternatives A-E	40.2 (16.3)
Total Recovery Habitat Impacted	**40.6 (16.5)**

This loss of recovery habitat on Guam would not preclude the recovery of *Serianthes*, and it would not substantially reduce the total number of *Serianthes* that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to *Serianthes* with implementation of proposed construction activities associated with Alternative D.

The following BMPs may be implemented to avoid and minimize, potential direct long-term impacts of proposed construction activities on the recovery of *Serianthes* with implementation of Alternative D.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.

- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

The implementation of the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 231 acres [94 ha] of limestone forest) would benefit *Serianthes* habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Special-Status Species: Guam-Listed and SOGCN

MICRONESIAN STARLING. This species has not been recorded in Barrigada and is rarely observed within the AAFB support areas. Therefore, there would be no impacts to the starling with implementation of Alternative D.

MOTH SKINK. A single moth skink was detected in a proposed utilities area along the southern border of AAFB within secondary limestone forest during surveys for this SEIS (NAVFAC Pacific 2013a) (Figure 4.1.8-5). Therefore, due to the extremely low occurrence of the skink within the proposed impacted areas, there would be less than significant impacts to the species with implementation of the proposed construction activities associated with Alternative D. However, implementation of the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 231 acres [94 ha] of limestone forest) would benefit the moth skink and its habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the moth skink.

Operation

Operational impacts would only occur for the proposed Alternative D. Operational requirements for the proposed utilities would require only periodic, limited maintenance activities along established utility corridors and impacts to biological resources would be less than significant. Consequently, only the potential operational impacts at the Alternative D are evaluated below.

Vegetation. With implementation of BMPs and potential mitigation measures, including invasive species outreach and education and applicable elements of the SIP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the cantonment and housing area under Alternative D is considered unlikely. Therefore, there would be less than significant impacts to vegetation with operation under Alternative D.

Terrestrial Conservation Areas. There are no terrestrial conservation areas at Barrigada. Although Overlay Refuge lands occur within the utility corridors and support areas on AAFB, operational requirements for the proposed utilities would require only periodic, limited maintenance activities along established utility corridors and impacts to biological resources would be less than significant.

Wildlife - Native Species. Potential impacts to wildlife were evaluated in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-101) for a similar proposed action but impacting a larger area, and were found to be less than significant.

Proposed operational activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. The following BMPs would be implemented to avoid and minimize potential indirect, long-term impacts of proposed operational activities on native wildlife with implementation of Alternative D.

Best Management Practices

- *Biosecurity Outreach and Education*. See the previous discussion of BMPs under construction impacts to *Vegetation* for a detailed description of Biosecurity Outreach and Education.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, Wildlife - Native Species for a detailed description of the brown treesnake interdiction program.
- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all new roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.
- *Prevention of Free-Roaming Cats and Dogs*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of DON policies regarding free-roaming cats and dogs.

With implementation of these BMPs, including ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the risk of the introduction and establishment of new or spread of existing non-native species on Guam is substantially reduced.

The implementation of the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 266 acres [107 ha] of limestone forest) would benefit habitat for native wildlife. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna.

Special-Status Species: ESA-Listed and Proposed Species

MARIANA FRUIT BAT. There are no historical fruit bat roost sites at Barrigada and there have been no observations of fruit bats at Barrigada since 1999. Although fruit bat recovery habitat occurs within the utility corridors and support areas on AAFB, operational requirements for the proposed utilities would require only periodic, limited maintenance activities along established utility corridors and impacts to Mariana fruit bats would be less than significant.

The following BMPs and potential mitigation measures may be implemented to avoid and reduce potential long-term impacts of proposed operational activities on the Mariana fruit bat with implementation of Alternative D.

Best Management Practices

- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

The implementation of the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 266 acres [107 ha] of limestone forest) would benefit habitat for the fruit bat and recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana fruit bat.

MARIANA CROW, GUAM RAIL, AND GUAM MICRONESIAN KINGFISHER. These species are extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of these species is reasonably certain to occur and the species are likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of these species, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow, rail, and kingfisher are successfully re-introduced and then have the potential to be exposed to cantonment and housing operational activities under Alternative D, there would be no impact to these species. If the species are reintroduced and exposed to cantonment and housing operational activities under Alternative D, they may be disturbed.

MARIANA COMMON MOORHEN. As there would be no suitable moorhen habitat (i.e., open water) within Alternative D after construction, there would be no impacts to moorhens due to operations associated with Alternative D.

TREE SNAILS. As there would be no suitable tree snail habitat within Alternative D after construction, there would be no impacts to tree snails due to operations associated with Alternative D.

SERIANTHES TREE. There would be no operational impacts to *Serianthes* or recovery habitat on AAFB with implementation of Alternative D.

Special-Status Species: Guam-Listed and SOGCN

MICRONESIAN STARLING. As this species has not been recorded from Barrigada, there would be no impacts to the starling due to operations associated with Alternative D.

MOTH SKINK. As there would be no suitable moth skink habitat within Alternative D after construction, there would be no impacts to the moth skink due to operations associated with Alternative D.

4.4.9 Marine Biological Resources

4.4.9.1 Affected Environment

The affected environment for marine biological resources was not analyzed for the Barrigada study area in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.6.2 Barrigada, page 11-51) as there were no in-water construction, dredging, or training activities proposed and/or land-based construction activities that would affect the marine environment. This is consistent with the proposed Alternative D; however, a brief description of the resources in the area is presented here to provide context for the discussion of WWTP upgrades and potential indirect impacts to marine biological resources from increased recreational use resulting from an increased population. Marine biological resources would not be impacted by Alternative D with respect to facilities common to all alternatives (i.e., schools and off-site utilities).

Alternative D would be located at an elevation ranging from approximately 200 to 400 feet (60 to 120 m) and more than 0.5 mile (0.8 km) from the coast and the BEQ/BOQ project area on AAFB would be located at an approximate elevation of 500 feet (150 m) and 0.7 mile (1.2 km) from the coast, and by extension, marine biological resources. The coastline here, between Pågat Point and Pago Bay, has few beaches - primarily small coves near Mangilao Golf Club that are privately owned. A trail called Thousand Steps consists of approximately 150 steep steps that provide public access to the beach at the Mangilao Golf Club. Uog Beach is noted as a Guam dive site.

General water quality is discussed under Section 4.4.1.3, Water Resources under Nearshore Waters for Agaña Bay, where the outlet for the Agaña WWTP (the WWTP utilized by Barrigada) is located.

Marine Flora and Invertebrates

The area around Barrigada moves from coralline algae to the north and macroalgae to the south to coral coverage of 10-50% to turf algae and unconsolidated sediment (Figure 4.4.9-1).

Fish

Despite the lack of beaches, fishing along the eastern coast of Guam is popular. Fishing in this area is primarily done by boat and only when ocean conditions allow. Fish biomass measured during the 2007 NOAA Pacific Islands Fisheries Science Center Coral Reef Ecosystem Division surveys, was the third highest of surveyed fish sites around Guam, and was dominated by parrotfish and surgeonfish (Williams *et al.* 2012).

Essential Fish Habitat

EFH-designated habitat areas east of Barrigada are those defined for bottomfish, crustaceans, coral reef ecosystems, precious corals, and Pacific pelagics. Benthic, coral reef, and fish condition in comparison to other survey areas around Guam, Rota, Tinian, and Saipan were ranked as low to medium-low from 2005 and 2007 survey index values (Williams *et al.* 2012).

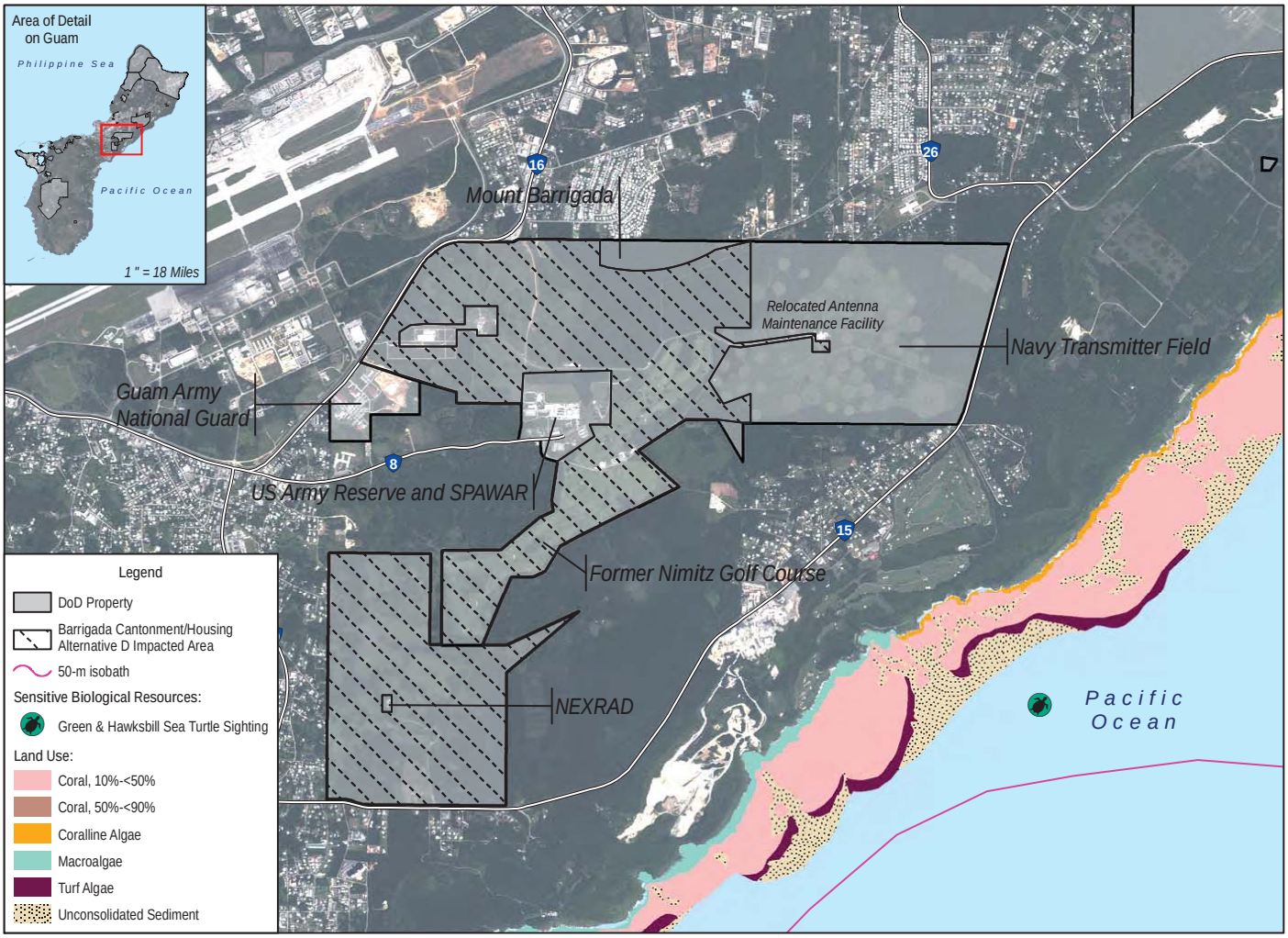


Figure 4.4.9-1
Overview of Sensitive Marine Biological Resources
and Nearshore Habitat – Barrigada Cantonment/Housing Alternative D

Sources: NOAA 2005a, b; NAVFAC Pacific 2013

Special-Status Species

Information on the presence of coral species listed as threatened under the ESA is lacking, but for the purposes of this SEIS, the coral species listed for AAFB under Section 3.9.9.1, Special-Status Species in Table 4.3.9-1 are assumed to be present along the coast by Barrigada as well.

A sea turtle sighting has been recorded offshore from the Mangilao Golf Club; however, green sea turtle nesting primarily occurs in northern Guam and has not been recorded in the area (hawksbill sea turtle nesting on Guam is extremely rare). For the purposes of this SEIS, green and hawksbill sea turtles are assumed to be present in the waters to the east of central Guam.

ESA-listed threatened scalloped hammerhead sharks have only been documented in Guam's Outer Apra Harbor, which has been noted for neonate and juvenile aggregations. While scalloped hammerhead sharks may occur in the surrounding waters around Guam, they are not anticipated to be prevalent outside Guam's Outer Apra Harbor.

There is no information on NMFS species of concern specific to the waters east of Barrigada. However, the presence of the bumphead parrotfish is likely given the high abundance of large fish, including generally classified parrotfish. The humphead parrotfish is not expected to occur in the waters around Barrigada.

Marine Conservation Areas

There are no marine conservation areas in the vicinity of Barrigada.

4.4.9.2 Environmental Consequences

Construction

Construction of the cantonment, family housing, and community support facilities would take place at Barrigada under this alternative. There are no anticipated direct impacts to marine resources as a result of the construction of the Alternative D. Construction of facilities common to all alternatives (i.e., schools and off-site utilities) would have no impact on marine biological resources.

In addition, all marine biological resources would be affected by the increased wastewater discharge from the Agaña WWTP for treatment and disposal of generated wastewater for the cantonment and housing at Barrigada and the Northern District WWTP for facilities located at AAFB. As discussed in Section 4.4.14, Utilities, in this SEIS, direct and indirect long-term impacts to wastewater from DoD and organic civilian population growth are estimated to increase the maximum monthly wastewater flows to the Northern District WWTP by 2028. Due to the reduced population projection and related smaller increase in demand under the 2012 Roadmap Adjustments, these increases in wastewater discharge from the Agaña WWTP and the Northern District WWTP would be less than under the No-Action Alternative. However, as described in Section 4.1.9.2 for Alternative A, the Northern District WWTP and Agaña WWTPs are out of compliance with their permit issued by USEPA in April 2013 and increasing the wastewater discharge from non-compliant treatment plants would result in significant indirect impacts to marine biological resources during the period of noncompliance. Upgrading the Northern District and Agaña WWTPs treatment systems (as required by the 2013 NPDES permit) would mitigate this significant impact to marine biological resources.

Impacts to water quality for marine biological resources resulting from increased WWTP wastewater discharges are discussed here and are not included in the analysis for each subcategory of marine biological resources below, which are limited to stormwater, sedimentation, and other non-point source

pollution and recreational impacts. The measures used to minimize these potential impacts include appropriate resource agency specific BMPs, construction and industrial permit BMPs, LID features in accordance with the DoD UFC LID (UFC 3-210-10) and Section 438 of the EISA, USACE permit conditions, and general marine resources protective measures, are described in the 2010 Final EIS (Volume 7 and Volume 2, Chapter 11: Marine Biological Resources, Section 11.2: Environmental Consequences, pages 11-70 to 11-71) and summarized in Chapter 2 of this SEIS. Specifically, the site-specific SWPPP within the Construction General Permit would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flowrate of runoff and thereby minimize suspension of sediment and promote infiltration of runoff.

Marine Flora and Invertebrates

The construction of the cantonment and housing at Barrigada would not directly impact marine flora and invertebrates. These resources would not be impacted directly by the proposed action because there are no in-water or land-based construction, dredging, or training activities associated with the proposed cantonment and housing construction at Barrigada that would impact the marine environment.

Indirect impacts to the coral reef ecosystem located near the project area may occur from increased use of this resource by construction workers. The magnitude of impacts is directly related to the increase in recreational use. However, contract construction personnel would be issued base passes for official business only and these restrictions would be specified in construction contracts.

The DON plans to educate construction workers via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities around Guam. Indirect short-term impacts to marine flora and invertebrates may still occur from increased nearshore activities in the area by construction workers.

With implementation of access restrictions and environmental education and outreach for the construction workforce, there would be no direct impacts and less than significant indirect short-term impacts to marine flora and invertebrates.

Fish

With implementation of access restrictions and environmental education and outreach for the construction workforce as described above for *Marine Flora and Invertebrates*, there would be no direct impacts and less than significant indirect short-term impacts to fish as a result of construction of the proposed cantonment and housing at Barrigada.

Essential Fish Habitat

The construction of Alternative D would result in no direct impacts and less than significant indirect impacts to EFH for reasons consistent with those given above for marine flora and invertebrates. There would be no impacts to EFH from stormwater, sedimentation, or other non-point source pollution from construction projects due to compliance with the Construction General Permit and the implementation of appropriate construction BMPs.

Per the Magnuson-Stevens Fishery Conservation and Management Act, there would be no adverse effect on EFH because construction of the proposed action would not reduce the quality or quantity of EFH with implementation of access restrictions, environmental education and outreach for the construction workforce, and the Construction General Permit and appropriate construction BMPs.

Special-Status Species

There would be no direct impacts and less than significant indirect impacts on special-status species as a result of the distance from the construction area to the shoreline, implementation of the Construction General Permit, implementation of appropriate construction BMPs, and access limitations for construction workers, as described for the resources above.

In-water sea turtles may be disturbed by increased recreational activity but potential impacts would be short-term and minimal, and generally unlikely given the distance of the proposed cantonment and housing from any beach used for recreation. Therefore, there would be less than significant, indirect impacts to sea turtles.

Marine Conservation Areas

There are no marine conservation areas near Barrigada; therefore, there would be no impacts to marine conservation areas as a result of the construction of Alternative D.

Operation

Marine biological resources would be impacted by the increased wastewater discharge from the Northern District WWTP and Agaña WWTP during the operation of cantonment/family housing under Alternative D. The associated potential impacts would be similar to those described earlier in this section for construction-related impacts. However, upgrades to bring the Northern District WWTP and Agaña WWTP into compliance with the permits are expected to be completed early in the operational phase of the proposed action and such upgrades would mitigate the impact to a less than significant level. Refer to construction impacts above for a detailed discussion of WWTP discharge impacts.

As discussed in Section 4.4.14, Utilities, in this SEIS, direct and indirect long-term impacts to wastewater from DoD and organic civilian population growth are estimated to increase the maximum monthly wastewater flows to the Northern District WWTP by 2028. Due to the reduced population projection and related smaller increase in demand under the 2012 Roadmap Adjustments, these increases in wastewater discharge from the Agaña WWTP and the Northern District WWTP would be less than under the No-Action Alternative. However, as described in Section 4.1.9.2 for Alternative A, the Northern District WWTP and Agaña WWTPs are out of compliance with their permit issued by USEPA in April 2013 and increasing the wastewater discharge from non-compliant treatment plants would result in significant indirect impacts to marine biological resources during the period of noncompliance. Upgrading the Northern District and Agaña WWTPs (as required by the 2013 NPDES permit) would mitigate this significant impact to marine biological resources. Potential mitigation to address this significant impact would be as described in the wastewater impact discussion for Alternative A in Section 4.1.2.2 but would include assistance with upgrading both the Agaña WWTP and Northern District WWTP. Therefore, with the potential mitigation measures, the impact to marine biological resources via water quality would be beneficial in the long term because wastewater discharge from the Agaña and Northern District WWTPs would improve over existing conditions with upgrades. Impacts to water quality for marine biological resources resulting from increased WWTP wastewater discharges are discussed here and are not included in the analysis for each subcategory of marine biological resources below, which are limited to stormwater, sedimentation, and other non-point source pollution and recreational impacts.

Marine Flora and Invertebrates

The operation of the cantonment and housing at Barrigada would not directly impact marine flora and invertebrates. These resources would not be modified from existing conditions considering the distance

and elevation from the shoreline and the implementation of protective measures to prevent stormwater runoff from reaching nearshore waters.

The DON plans to educate its service members and their dependents via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities. The Environmental Compliance Assessment, Training and Tracking System program is one possibility for such an educational training program to minimize these potential increased, recreational impacts to marine flora and invertebrates.

Implementation and enforcement of appropriate BMPs (provided in Chapter 2) and protective measures would further avoid and minimize potential long-term, indirect impacts to marine flora and invertebrates from stormwater, sedimentation, and other non-point source pollution from operational activities. For example LID measures would include vegetated swales for conveyance and detention/retention ponds capable of capturing, storing, and treating additional runoff from the 25-year design storm. For each basin, water quality treatment strategies were selected based on the effectiveness of BMPs to treat identified pollutants of concern from proposed land uses within that basin. Implementation of LID measures would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event.

With implementation of environmental education and outreach for DON service members and their dependents and operation and maintenance of LID measures and BMPs, there would be no direct impacts and less than significant indirect short-term impacts to marine flora and invertebrates.

Fish

There would be no direct impacts to fish as a result of the operation of the cantonment and housing at Barrigada. Indirect impacts to fish stocks may occur from increased use of this resource by DoD personnel and their dependents living and working at Barrigada. The magnitude of impacts is directly related to the increase in recreational use.

The DON plans to educate its service members and their dependents via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities. The Environmental Compliance Assessment, Training and Tracking System program is one possibility for such an educational training program to minimize these potential increased recreational impacts to fish.

Implementation and enforcement of appropriate BMPs (provided in Chapter 2) and protective measures would further avoid and minimize potential long-term, indirect impacts to fish from stormwater, sedimentation, and other non-point source pollution from operational activities. For example, LID measures would include vegetated swales for conveyance and detention/retention ponds capable of capturing, storing, and treating additional runoff from the 25-year design storm. For each basin, water quality treatment strategies were selected based on the effectiveness of BMPs to treat identified pollutants of concern from proposed land uses within that basin. Implementation of LID measures would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event.

With implementation of environmental education and outreach for DON service members and their dependents and operation and maintenance of LID measures and BMPs, there would be no direct impacts and less than significant indirect short-term impacts to fish.

Essential Fish Habitat

The operation of the cantonment and housing at Barrigada would result in no direct impacts and less than significant indirect impacts to EFH for reasons consistent with those given above for marine flora and invertebrates. With implementation of environmental education and outreach for DON service members and their dependents and operation and maintenance of LID measures and BMPs, there would be no direct impacts and less than significant indirect short-term impacts to EFH as a result of stormwater, sedimentation, and other non-point source pollution and recreational impacts. Per the Magnuson-Stevens Fishery Conservation and Management Act, the DON has determined that during the interim period of change when the effluent discharged from the Agaña and Northern District WWTPs would not meet Guam Water Quality Standards, the proposed action may adversely affect EFH, but effects would be temporary and less than significant (see discussion above under *Operation*). In accordance with the Magnuson-Stevens Fishery Conservation and Management Act, the DON has requested consultation with NMFS about effects to EFH during the interim period.

Special-Status Species

There would be no direct impacts and less than significant indirect impacts on special-status species as a result of the operation of the cantonment and housing at Barrigada. Impacts would be avoided and minimized through the implementation and management of appropriate BMPs and access limitations to military personnel and their dependents as described for the resources above. There would be no impacts on special-status species from stormwater, sedimentation, or other non-point source pollution from operational activities due to the implementation of appropriate LID and BMPs.

Increased dive boat operations have the potential for increased turtle harassment and strikes. However, because of the mobility of sea turtles combined with the protective measures anticipated to be in place (i.e., by dive boat operators and the DON), such increased recreational activities may result in less than significant impacts to sea turtles. While sea turtles may be disturbed by increased recreational activity, potential impacts would be short-term and minimal. Any such impacts to the sea turtle population would be reduced in intensity from the previously proposed action evaluated in the 2010 Final EIS.

Marine Conservation Areas

There are no marine conservation areas near Barrigada; therefore, there would be no impacts to marine conservation areas as a result of the operation of Alternative D.

4.4.10 Cultural Resources

4.4.10.1 Affected Environment

The following discussion summarizes previous cultural resources studies and known historic properties and other cultural resources within the area of potential cultural resource impacts associated with Alternative D. The discussion below addresses historic properties, as defined in the NHPA, and other cultural resources as defined under NEPA. The discussion refers to the terms *direct effects* and *indirect effects* to historic properties as defined under the NHPA, and impacts to other cultural resources as defined under NEPA (see Section 3.10.3.2). The section is organized to address cultural resources for the cantonment/family housing, followed by discussion of the same resource types for off-site utilities and school expansions associated with this alternative. If this alternative is selected for implementation, the information presented here would be augmented by reviews consistent with the 2011 PA, which provides overall NHPA Section 106 compliance and addresses other cultural resource issues. Refer to Section 3.10 for a detailed description of the 2011 PA. Additionally, some built properties in this section are covered

by *Program Comments* executed by the ACHP, which resolve Section 106 responsibilities for certain DoD facilities. See Chapter 3, Section 3.10 for more information on definitions and procedures.

Barrigada is located on the northeastern side of Guam and includes portions of both Air Force Barrigada and Navy Barrigada. The site supports a large antenna field developed around an active transmitter facility, which was originally constructed in the late 1940s. A portion of the area is leased to the Guam Army National Guard for small-unit tactics and land navigation training. In the 1950s, the DON constructed new, permanent military facilities including personnel housing, communication centers, and bases. Alternative D would consist of construction and operation of administrative and housing areas, community support facilities (e.g., schools, child development center, community center), and associated utilities (see Figure 2.4-10 in Chapter 2 of this SEIS).

The affected environment for cultural resources associated with Alternative D is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 12: Cultural Resources, Section 12.1.3.2: Barrigada, pages 12-21 to 12-23). This description of the affected environment provided here has been updated with new information from recent archaeological and architectural investigations supporting this SEIS and other projects. To determine whether information is from an existing reference (such as the 2010 Final EIS or other cultural resource studies) or collected during in-fill studies conducted in support of this SEIS, refer to dates in the reference column in each table for the archaeological sites. Information for the architectural resources was derived from iNFADS.

Surveys conducted to support the 2010 Final EIS included the PDIA for Alternative D. Those and other previous investigations included intensive archaeological surveys (Athens 2009; Dixon *et al.* 2011a), architectural overviews (Craib and Yoklavich 1996; Mason Architects and Weitze Research 2010), potential TCP studies (Griffin *et al.* 2010), and oral histories (Welch 2010). An archaeological survey of 98 acres (40 ha) and an architectural survey of buildings on the Nimitz Golf Course were conducted for this SEIS (Dixon *et al.* 2014). Recently, previously unknown archaeological materials were discovered within the Nimitz Golf Course (Bulgrin 2014). Consultation on treatment of these resources is in process. These investigations provide a comprehensive inventory of cultural resources occurring within the Alternative D PDIA.

In addition to the primary cantonment/family housing areas, on-site utility corridors associated with Alternative D would be located along the easements of Routes 3, 16, and portions of Route 8 (see Figure 2.4-11). A reconnaissance level survey was conducted for the proposed utilities adjacent to Route 3 and Route 16 to north Barrigada in 2010 and no archaeological sites were recorded (Dixon and Walker 2011). Unsurveyed portions of Route 16 are highly developed and primarily paved, and unlikely to have buried cultural resources (based on literature review of available studies in the area indicating that geologic context lacks the depth typically associated with intact deposits below the level of disturbance from development and pavement).

All cantonment alternatives would include construction of off-site utilities along Routes 1, 3, and 9, a water well field at AAFB, and expansion of two schools at Naval Base Guam and AAFB (see Figure 2.4-14). Assessments of potential impacts to cultural resources from construction of utilities along road right-of-ways are based on a reconnaissance survey of portions of the area in 2010 (Dixon and Walker 2011) and a literature review of previous surveys and historic development in the area. Assessments of impacts to cultural resources from the development of a water well field and from the two school expansions are based on the in-fill surveys conducted in support of this SEIS (Dixon *et al.* 2014)

Based on data from previous surveys of the proposed cantonment/family housing area and utility corridors, Table 4.4.10-1 lists 16 known archaeological sites or locations with archaeological materials within the Alternative D PDIA on Barrigada. No known NRHP-eligible or listed archaeological sites are located in the PDIA for Alternative D. Thirteen locations with Latte Period pottery were recently recorded in disturbed areas of the Nimitz Golf Course. None of these locations have been evaluated for listing in the NRHP.

Table 4.4.10-1. Archaeological Sites within the Barrigada Cantonment/Family Housing Alternative PDIA

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-04-1690	810*	Concrete remains	Post-WWII/ Second American Territorial	Hunter-Anderson *et al.* 2001	No	NA
	RB1/422*	Naval Communication Station Barrigada foundations	Post-WWII/ Second American Territorial	Olmo *et al.* 2000	No	NA
66-04-2757	T-BAR-100	Ceramic scatter	Pre-Contact/Latte	Dixon *et al.* 2014	No	NA
	Location 1	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 3	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 4	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 5	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 6	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 7	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 8	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 9	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 10	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 11	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 12	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 13	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA
	Location 14	Ceramic scatter	Pre-Contact/Latte	Bulgrin 2014	Not Evaluated	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA = not applicable.
Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.
*Map numbers are from Welch *et al.* (2009).
** Revised to match Guam GHPI forms dated May 28, 2014.

Two archaeological sites, 66-08-2714 and T-H-1, have been identified within the potential impacted area for Alternative D on-site utility corridors. These sites are considered not eligible for listing in the NRHP. A potential TCP, Mount Barrigada, is located at the northern end of the Barrigada site. There are 44 architectural properties, constructed between 1948 and 2007 within the cantonment/family housing PDIA (Table 4.4.10-2). These buildings and structures include dormitories, support facilities, and recreation facilities. Thirty-seven buildings and structures have been determined ineligible for listing in the NRHP (Dixon *et al.* 2014); including 31 buildings that are less than 50 years old and do not meet the exceptional significance threshold required under NRHP Criteria Consideration G. Five buildings are bachelor housing (dormitories and support facilities) covered under the *Program Comment for Cold War Era Unaccompanied Personnel Housing* (ACHP 2006; see Chapter 3.10.3 for more information on the Program Comment). Two buildings and structures in the PDIA are facilities that are greater than 50 years in age that have not been evaluated. If Alternative D were selected, any potentially affected unevaluated properties would be evaluated under the procedures identified in the 2011 PA. The 2011 PA includes procedures for the identification of historic properties, as specific projects are developed, through consultation with the Guam SHPO and the public.

Table 4.4.10-2. Summary of Architectural Properties Located within the Barrigada Cantonment/Family Housing Alternative PDIA

Building/Structure Type	*Location*	*Number of Buildings/Structures of this Type in Impacted Area*	*Date of Construction*	*NRHP Eligible?*
Admiral Nimitz Golf Course	Barrigada	1	1948	No
Admiral Nimitz Golf Course Club House	Barrigada	1	1954	No
Dormitories	AAFB	4	1948 to 1954	Covered under Program Comment
Visitor's Quarters	AAFB	1	1954	Covered under Program Comment
Support Facilities				
Hydrologic Support Facilities	Barrigada	2	1955	Not Evaluated
Admiral Nimitz Golf Course Support Buildings	Barrigada	22	1954 to 2007	No
Support Facilities	Barrigada	3	1963 to 1995	No
Support Facilities	AAFB	8	1966 to 1994	No
Well	Barrigada	1	1989	No
Billboard Sign	AAFB	1	2007	No

In addition to the cantonment/family housing, and utility corridor areas, Alternative D would include construction of off-site utilities, a water well field, and expansion or construction of two schools. Cultural resources are similar to those discussed under Alternative A. These include the presence of 9 NRHP-eligible archaeological sites and 15 sites not considered eligible for listing in the NRHP (see Alternative A, Table 4.1.10-4). As under Alternative A, 1 structure within the well development area on AAFB is eligible for listing in the NRHP, 4 structures are not eligible, and 6 structures are unevaluated (see Alternative A, Table 4.1.10-5). No architectural properties or TCPs have been identified within the off-site utilities PDIA.

The proposed Andersen Middle School expansion and the DoDEA High School construction are common to Alternatives A, B, and D. The proposed Andersen Middle School project area contains three structures at AAFB, which are not eligible for listing in the NRHP (see Alternative A, Table 4.1.10-5). No archaeological sites or TCPs have been recorded in this area.

4.4.10.2 Environmental Consequences

Construction

Construction activities associated with Alternative D may adversely affect historic properties. Final determinations of effect would occur under the 2011 PA. Following is a discussion of potential adverse effects for purposes of this analysis. Excavation and soil removal associated with building and utilities construction would not adversely affect any known NRHP-eligible archaeological sites (see Table 4.4.10-1); however, 13 locations containing archaeological materials could be adversely affected, if they are determined eligible for listing in the NRHP.

Construction at Barrigada would also require the demolition of the 44 buildings mentioned above (see Table 4.4.10-2). Of these 44 buildings, 37 buildings have been determined ineligible for listing in the NRHP, 5 are covered under the *Program Comment for Cold War Era Unaccompanied Personnel Housing* (ACHP 2006), and 2 are unevaluated. The Program Comment resolves NHPA Section 106 requirements for demolition of these five buildings. As the 37 buildings are not eligible for listing in the NRHP, their demolition under Alternative D would be consistent with a finding of no historic properties affected. Consistent with the 2011 PA, final determinations of eligibility, including the two unevaluated architectural properties and the 13 locations with archaeological materials, and assessment of effect would be completed in conjunction with project-specific reviews, if this alternative is developed. Excavation and soil removal associated with the construction of off-site utilities and expansion of two schools could adversely affect 9 known NRHP-eligible archaeological sites (see Alternative A, Tables 4.1.10-4 and 4.1.10-5) and 1 NRHP-eligible structure. Six structures that are unevaluated could also be adversely affected by construction.

The proposed Andersen Middle School expansion would require the demolition of three structures that are not eligible for listing in the NRHP (see Alternative A, Table 4.1.10-6).

In addition, construction at Barrigada has the potential to directly impact culturally important resources that are not historic properties, but may be considered under NEPA. The project would require the removal of limestone forest where culturally important natural resources may be present. The 2011 PA contains measures for coordinating with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans regarding identification and disposition of these important resources (see 2010 Final EIS, Volume 2: page 2-10; Volume 9, Appendix G, Chapter 4).

Operation

Operations associated with Alternative D would not directly affect any historic properties or impact other resources of cultural importance. Similarly, operations under this alternative would result in no indirect adverse effects. Increased population in this area would not adversely impact Mount Barrigada since the operations would not limit access to the property, or adversely impact its association with Chamorro legends.

Summary of Impacts and Potential Mitigation Measures

Implementation of Alternative D could cause direct, adverse effects to 9 known NRHP-eligible sites, which is the smallest number of effects compared to any of the alternatives. Refer to Section 4.7, Table

4.7-1 for a comparison of cultural resources impacts and potential mitigation measures for each cantonment/family housing alternative. Construction could also affect 13 locations with archaeological materials and 8 buildings that have not been evaluated for listing in the NRHP.

Direct impacts could occur to natural resources of cultural importance as a result of limestone forest removal. The 2011 PA includes measures to coordinate with SHPO and concurring parties to address appropriate treatment of these resources.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. Broadly, the 2011 PA includes processes to share information, consider views of the public, and develop mitigation measures when historic properties may be adversely affected. The 2011 PA provides measures for mitigating adverse effects to NRHP-eligible or listed archaeological sites, consulting on new projects and initiating additional identification efforts, and resolving impacts due to loss of access to culturally important natural resources. To the degree possible, direct and indirect impacts to historic properties and other resources of cultural importance would be avoided or minimized during the planning process. Consultation under the 2011 PA would address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, Table 4.4.10-3 presents potential mitigation measures to resolve adverse effects to historic properties and reduce impacts to cultural resources from the implementation of Alternative D. With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that significant direct and indirect impacts due to construction, as defined under NEPA, would be reduced to a level below significance.

Table 4.4.10-3. Potential Mitigation Measures for Alternative D for Adverse Effects (NHPA) and Impacts to Other Cultural Resources (NEPA)

NHPA Effects	***Mitigation***
Potential direct adverse effects to 10 historic properties—9 NRHP-eligible archaeological sites and 1 NRHP-eligible structure	Consistent with the 2011 PA, data recovery is the standard mitigation for historic properties that are strictly archaeological in nature. Accordingly, the DON will submit a mitigation plan to the SHPO, consult with other PA Signatories and Concurring Parties if requested, and submit data recovery reports for SHPO review prior to finalizing mitigation reports. Mitigation also includes preparation of public education and interpretation materials in English and Chamorro using the information developed or data recovered to create a summary of the work completed and a statement regarding the mitigated site's significance to the regional culture. Additional mitigation would include enforcement of construction contract stipulations and GHPI data form updates as required by the 2011 PA.
Undetermined effects to 13 unevaluated archaeological locations and 8 unevaluated buildings	If this alternative is selected in the ROD, unevaluated properties that may be affected would be evaluated consistent with the 2011 PA. If determined eligible for listing in the NRHP, appropriate mitigation measures would be developed to resolve any adverse effects.
NEPA Impacts	***Mitigation***
Potential direct impacts to culturally important natural resources	Through the 2011 PA process, coordinate with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans to provide an opportunity to collect these resources consistent with installation security instructions and safety guidelines.

4.4.11 Visual Resources

4.4.11.1 Affected Environment

A list and description of visual resources at Barrigada is contained in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.1.2.3: Affected Environment, page 13-32). The Barrigada area is relatively flat and varies from mowed grassland to dense, natural vegetation. Rural and suburban lands surround the Navy and Air Force Barrigada site. Due to the relatively flat topography and moderate to heavy vegetation, the surrounding community of Barrigada has limited views into the Navy and Air Force Barrigada site. One exception is the view from Mount Barrigada, just north of the potential Barrigada cantonment and housing area.

4.4.11.2 Environmental Consequences

Off-base housing was proposed and analyzed with two alternatives in the 2010 Final EIS. The proposed development at Barrigada reviewed in this SEIS would involve both housing and cantonment development. The visual impacts would be greater with this enhanced development proposal.

Construction

Because there is less development associated with the proposed action due to a smaller number of Marines and dependents being relocated, the degree of impacts would be less than those described in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.2.2: Environmental Consequences, pages 13-65 to 13-67). The direct impacts to existing public views would be short-term, as they would be caused by the presence of construction equipment, and would cease to continue after construction. Therefore, there would be minimal direct and short-term impacts on visual resources.

Operation

Similar to the 2010 Final EIS analysis, development is proposed contiguous to various public roadways, including Route 15 and Route 16. With the construction of the cantonment and the family housing, the visual characteristic would be altered to a more urban appearance. Although the degree of what would be built is much greater than proposed in the 2010 Final EIS, the resulting direct impacts to the visual element would be long-term, but less than significant, since the visual character of the base would not be drastically altered.

4.4.12 Ground Transportation

4.4.12.1 Affected Environment

The affected environment under Alternative D includes transportation facilities internal to the site (on-base roadways and intersections) and entry control facilities. This section discusses existing conditions and assesses how the construction and operation of Alternative D would potentially affect conditions for roadways, transit facilities, and pedestrian and bicycle facilities on-base. Impacts to off-base (external) roadways and intersections are summarized in Section 6.1 of this SEIS.

Roadway Network

Gated access points are provided at Route 16 and Sabana Barrigada Drive. Route 15 forms the eastern bounding edge and Route 16 forms the western bounding edge of the Navy Barrigada parcel, which abuts the northeastern edge of the Air Force Barrigada parcel. Route 15 forms the southern edge of the Air Force Barrigada parcel. The primary point of entry into the Air Force Barrigada site is from the south side, where an unnamed access street intersects Route 15. The access point is located at the intersection of Chada Street and Route 15. Chada Street is an off-base roadway that intersects Route 15 from the

southern side. The Air Force Barrigada parcel could also potentially be accessed from the western side, from Route 10, by heading into Lalo Street.

Transit Network

There is no existing transit service on Barrigada. The GRTA operates fixed route and paratransit service. The Redline, servicing Hagåtña, Mangilao, Barrigada, and Toto, is the nearest fixed route bus line, and operates at a distance of approximately 1.0 miles (1.6 km) from Barrigada. Paratransit service is provided to all ADA-eligible certified passengers, by providing transportation to the nearest fixed route.

Pedestrian and Bicycle Network

There are no dedicated pedestrian or bicycle facilities on or near Barrigada. Typically, the outside lane or shoulder, which is generally unpaved, functions as the pedestrian/bicycle space.

4.4.12.2 Environmental Consequences

Potential ground transportation impacts addressed in this section are limited to elements of the proposed action that could affect on-base (internal) roadways. Potential ground transportation impacts to off-base (external) roadways are addressed in Section 6.1 of this SEIS.

Construction

Potential construction impacts generated by the proposed action at Alternative D would be similar to Alternative A (Section 4.1.12.2). Potential short-term, direct impacts to ground transportation resources from construction would be reduced to less than significant levels with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, construction of Alternative D would have less than significant short-term, direct impacts to on-base (internal) roadways.

Operation

Roadway Network

As currently proposed, Alternative D would be accessible via a new Main Gate and a new Commercial Gate located at Route 15 in the southern part of the site, as well as a new Residential Gate in the northern part of the site at Route 16. The buildings and facilities at Alternative D would be grouped into three contiguous development areas.

The proposed on-base (internal) roadway network hierarchy for Alternative D was determined based on the conceptual development plan and layout of the cantonment/family housing area, and takes into account the capacity required to accommodate the expected travel demand on the facilities. The proposed on-base (internal) roadway network hierarchy diagram for Alternative A is included in an Appendix to this SEIS.

An arterial four-lane roadway would traverse the site from the proposed new Main Gate on the south to the proposed new Residential Gate on the north end of the site. This roadway would be expected to carry the heaviest traffic volumes, including civilian employee trips from off-base to/from work locations, as well as trips by military personnel to/from off-base locations. A shorter east/west arterial roadway is proposed to carry traffic from the north/south arterial to the live/work and QOL areas at the cantonment area in the southern part of Barrigada. Collector roadways would distribute traffic within the core area and would provide much of the access to individual buildings, operational areas, and parking facilities. Residential two-lane roadways located within the family housing area would provide access to individual residences.

Under any of the proposed cantonment/family housing alternatives, construction of new on-base (internal) roadway facilities and entry control facilities would be required. The proposed action includes construction of on-base (internal) roadways and entry control facilities that would be implemented by the DoD. On-base (internal) roadways and entry control facilities for Alternative D, include, but are not limited to, the following:

- A new Main Gate would be constructed on Route 15, and would provide direct access to the cantonment area at the south end of the site.
- A new Commercial Gate would be constructed on Route 15, and would provide direct access to the cantonment area for commercial vehicles.
- A new Residential Gate would be constructed on Route 16, and would provide direct access to the family housing area at the north end of the site.
- A four-lane arterial roadway would run from the new Main Gate on Route 15 to the new Residential Gate on Route 16.

All on-base (internal) roadways and intersections have been designed with the capacity required to accommodate the expected travel demand on the facilities. Specifically, the facilities are designed to operate at acceptable LOS (LOS A, B, C, D, or E) under future year (Year 2030) conditions with the proposed action. The proposed action would not result in a significant long-term, direct impact to on-base (internal) roadways or intersections because the proposed action would not:

- For roadway segments and intersections - cause a roadway segment or intersection operating at acceptable LOS (LOS A, B, C, D, or E) to degrade to unacceptable LOS F.
- For roadway segments - add 5% or more to the total directional peak hour volume (measured in passenger car equivalents) and result in unacceptable LOS F.
- For intersections - add 50 or more peak hour trips (measured in passenger car equivalents) and result in unacceptable LOS F.

Entry Control Facilities

The operations of the proposed entry control facility are controlled, or dictated, by both the traffic demand and the vehicle processing speed at the security check point. The methodology and assumptions utilized to evaluate operations and potential for queuing at the entry control facilities is stated in Section 4.1.12.1.

Transit Conditions

A circulator shuttle system is being considered to address the internal transportation needs of the cantonment. The shuttle system would transport Marine Corps personnel around the cantonment area and provide service to on-base destinations. On-base shuttle service could also coordinate with the GRTA bus system to provide service to popular off-base destinations as well.

The proposed action would not result in a significant long-term, direct impact to transit, because the proposed action would not:

- Substantially increase traffic hazards to transit due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with applicable design standards.
- Fundamentally conflict with adopted policies, plans, or programs regarding public transit; or otherwise decrease the performance or safety of transit facilities.

Pedestrian and Bicycle Conditions

Bicycle and pedestrian facilities would be included in the construction of new roadway facilities. Bicycle and pedestrian paths and facilities are integrated into the on-base transportation network as a means to improve mobility and safety of non-motorized traffic. The proposed bicycle and pedestrian network diagram for Alternative D is provided in an Appendix to this SEIS.

The proposed pedestrian and bicycle network includes an extensive multi-purpose trail network along most major roadways. An enhanced pedestrian sidewalk would connect community support and QOL facilities within the cantonment area. All residential streets would be constructed with sidewalks on both sides of the street. A jogging/biking trail would circumnavigate the family housing area, connect to the cantonment area, and continue around the periphery of the cantonment area.

The proposed action would not result in a significant long-term, direct impact to pedestrians or bicycles, because the proposed action would not:

- Substantially increase traffic hazards to pedestrians or bicycles due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with applicable design standards.
- Fundamentally conflict with adopted policies, plans, or programs regarding bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

4.4.13 Marine Transportation

4.4.13.1 Affected Environment

The affected environment for marine transportation under Alternative D is the same as described in Section 4.1.13.1 for Alternative A.

4.4.13.2 Environmental Consequences

The environmental consequences for marine transportation under Alternative D would be the same as described in Section 4.1.13.2 for Alternative A.

4.4.14 Utilities

4.4.14.1 Affected Environment

This section includes information related to existing electrical, potable water, wastewater, solid waste, and IT/COMM utilities as they apply to the Alternative D.

Electrical Power

The existing electrical utility for Alternative D consists of power distribution systems serving the former golf course, antenna field, and other existing facilities. This existing infrastructure is quite minimal and is concentrated in the northern area of Barrigada, where the National Guard and Army Reserves have their facilities. The power being supplied to this area comes from the GPA transmission and generation system. The situation and condition of these utility systems is unchanged from the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1: Affected Environment, page 3-5).

Potable Water

The existing potable water utility pertaining to Alternative D consists of a water supply well for irrigation, and DoD water distribution systems serving the former Nimitz Golf Course and other existing facilities. This utility system remains basically unchanged from the description provided in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1: Affected Environment, page 3-10). In January 2013, the

Admiral Nimitz Golf Course was shut down and closed operations, so water usage by that facility has ceased. There is an existing 3.0 MGd (11.4 MLd) ground-level concrete water storage tank at the north area on Mount Barrigada that is part of the DoD water system.

Existing facilities at Barrigada are served solely by the DoD water system. The overall affected environment of the DoD and the GWA potable water systems is the same as described under Alternative A in Section 4.1.14.1 under Potable Water.

Wastewater

The GWA compliance background discussed in Alternative A Section 4.1.14.1 is the same for Alternative D. The current major wastewater compliance requirements for GWA are covered under a 2011 court order, a USEPA NEIC inspection conducted in 2012, and 2013 NPDES permits requiring treatment upgrades for the Northern District WWTP and Agaña WWTP.

The affected environment for wastewater utilities associated with Alternative D is described in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1: Affected Environment, pages 3-26) and updated in Section 4.1.14.1.

Alternative D has an existing wastewater collection system serving Navy Barrigada. The existing system includes approximately 13,000 feet (3,962 m) of gravity sewer lines ranging from 6 to 8 inches (15 to 20 cm) in diameter. The wastewater generated from Navy Barrigada is conveyed to the Agaña WWTP through the GWA collection system.

A capacity assessment of the GWA collection system was conducted in the 2007 Water Resource Master Plan. The assessment included flow and rainfall monitoring, hydraulic modeling, model calibration, and sewer capacity evaluations. Capacity assessment of the collection system was assessed for the year 2025. For the Agaña WWTP service area, the estimated wastewater projection was 9.1 MGd average daily flow by the hydraulic sewer model, which is reasonably close to the projected wastewater flow for the proposed action. The modeling results for the Agaña WWTP service area indicated the pipe segments along Route 10 and Route 8 were adequately sized. However, the model results did indicate under-sized pipe segments along Route 1, upstream of the Agaña WWTP. The GWA has taken steps to alleviate the capacity limitations to the central wastewater system, particularly with the upgrades to pump stations and more periodic sewer cleaning and inspections, as required by a 2011 Court Order. Other ongoing and future GWA Capital Improvement Plan projects include the Central Inflow and Infiltration Analysis and Sewer System Evaluation Survey, and the Wastewater Collection System Replacement/Rehabilitation Program.

The GWA is also in the process of updating the hydraulic sewer model used in the 2007 Water Resource Master Plan. The updated model could then be used to indicate where system limitations and failures are located, as well as where maintenance and/or replacement of piping and pump stations should be targeted. Comprehensive visual inspections of the collection systems and a hydraulic model are critical first steps in assessing the condition of the collection system. Undertaking these first steps would allow critical prioritization of maintenance and upgrades to the system, and necessary validation of the GWA Capital Improvement Plan for the collection systems. Until this is done, the DoD can only assess indirect impacts qualitatively.

The island-wide GWA wastewater collection system has undergone periodic inspections and cleaning as required under the 2011 Court Order. In an effort to meet compliance with the 2011 Court Order, the GWA is also proceeding with inflow and infiltration analyses, and sewer system evaluation surveys for

the central and southern collection systems and has added on the northern collection system as described in Section 4.1.14.1.

As required by the 2011 Court Order, primary treatment upgrades at the Agaña WWTP have been completed as of March 2014. The Agaña WWTP has a design capacity of 12 MGd (45.4 MLd). However, with the issuance of a 2013 NPDES permit, the plant currently has no operational ability to meet the new treatment discharge limits.

The Northern District WWTP would receive direct wastewater flows from Alternative D from facilities located on AAFB. Similar to the Agaña WWTP, the Northern District WWTP has a design capacity of 12 MGd (45.4 MLd). The 2013 NPDES permit requires meeting the secondary treatment discharge limits and Guam Water Quality Standards, including those for nutrients, which the plant cannot meet until it is upgraded. Thus, both WWTPs are currently in a state of non-compliance with the 2013 NPDES permits.

The Southern GWA WWTPs Agat-Santa Rita, Baza Garden, and Umatac-Merizo, are described in Section 4.1.14.1.

Solid Waste

The existing solid waste infrastructure has changed since the publication of the 2010 Final EIS. Solid waste continues to be collected and taken off-site for disposal. Currently, DoD contractors pick up waste from the Barrigada site and take it to the Harmon Transfer Station for disposal at the Layon Landfill. Other wastes not accepted by the Layon Landfill can be disposed at either AAFB or Naval Base Guam Apra Harbor facilities. The DON is currently coordinating with the GEPA regarding the status of the MSW landfill permit for the Naval Base Guam Landfill. The Solid Waste Working Group consisting of the DoD, GEPA and USEPA was established to coordinate and resolve landfill permitting issues, as well as other solid waste issues on Guam.

Information Technology and Communications

The existing IT/COMM infrastructure at Barrigada includes existing DoD telecommunication lines serving existing facilities, including the antenna field to the east of the proposed family housing area. There is no existing IT/COMM utility in the proposed cantonment area at Barrigada.

4.4.14.2 Environmental Consequences

The assessment of impacts associated with utilities assumed the implementation of sustainability strategies as described in Section 8.6, Sustainability and Smart Growth. These strategies include measures to achieve federally mandated levels of energy use reduction, water use reduction, waste reduction, and total energy from renewable sources.

Electrical Power

Based on the load projections for both the cantonment area and family housing, no upgrade would be required to the GPA's generating capacity, since the total load increase is within the capacity of their generating plants. However, upgrades to the existing 34.5 kV power transmission lines would be required to stay within operating tolerances. The current electrical power system at Barrigada is not capable of meeting the increased demand from the proposed Marine Corps relocation. Thus, Alternative D includes an expanded electrical power distribution system with additional power feeds from the GPA as described in Section 2.4.4.4. This electrical power distribution system has been developed to handle all system demands currently in existence for areas served by the current local power distribution system, in addition to increased demands from the proposed action. Thus, there would be no long-term adverse direct

environmental impacts to the current power customers, and only potentially short-term power outages during construction of the expanded system.

Impacts to the island-wide GPA power system under Alternative D would be the same as for Alternative A, as described in Section 4.1.14.2. In addition, the existing 34.5 kV transmission system from Guam Airport Authority Substation to the existing Barrigada Substation would require upgrading. The proposed new substation for the cantonment/family housing area at Barrigada would be connected to this upgraded transmission system, providing a double feed option for electrical power security.

Therefore, the short- and long-term, direct impacts to the power system would be less than significant, both during construction and in operation.

Potable Water

The existing water system within the affected environment at Barrigada does not have the supply capacity or sufficient distribution network to handle the demand from the proposed development. The current water system for existing facilities would remain in service, but be integrated with the proposed expanded water system for operational efficiency. The proposed potable water distribution system for Alternative D as described in Section 2.4.4.4 has been developed to handle all system demands currently in existence for areas served by the current local water distribution system, in addition to the increased demand from the proposed action. Thus, there would be no adverse long-term, direct environmental impacts to the current DoD water customers, and only the potential for short-term water outages during construction of the expanded system. With careful planning these potential outages would be minimized.

DoD Potable Water System

Potential direct long- and short-term impacts to the DoD system would be the same for Alternative D as for Alternative A, as described in Section 1.14.1.2. Some additional required upgrades to the existing off-base transmission mains along Route 1 and Route 16 would be needed to convey the required water supply to Barrigada. The construction of the upgrade could require short-term outages during construction but would be installed adjacent to the existing main and switched over in phases to minimize water service interruptions to current customers. With careful planning these potential outages would be minimized.

GWA Potable Water System

Potential impacts to the GWA system would be the same for Alternative D as for Alternative A, as described in Section 4.1.14.2. The long- and short-term direct impacts to the GWA potable water system from the proposed action Alternative D would be less than significant, both during construction and in operation.

NGLA Water Extraction

Potential short- and long-term impacts to the NGLA, and potential mitigation measures of impacts, would be the same for Alternative D as for Alternative A, as described in Section 4.1.14.2. Thus, the localized direct impact to the NGLA is considered significant, but the impact to the overall NGLA would be less than significant. Potential mitigation measures for impacts to the NGLA would be the same as those discussed in Section 4.1.14.2 for Alternative A.

Wastewater

Wastewater generated from Alternative D would be collected, conveyed to, treated, and disposed of at the Agaña WWTP for facilities located at Navy Barrigada, and at the Northern District WWTP for facilities

located at AAFB. Proposed facilities located on AAFB would have similar environmental consequences as described in Alternative A in Section 4.1.14.2. Baseline and projected average and total monthly flows for the Northern District WWTP and Agaña WWTP are shown in Tables 4.4.14-1 and 4.4.14-2.

Table 4.4.14-1. Northern District WWTP Wastewater Flows

Wastewater Impact	*Total Monthly Average Flow (MGd)*	*Total Monthly Maximum Flow (MGd)*	*% Increase Average Flow from Baseline*
Baseline	5.1	11.48	NA
Notional Increase	1.49	2.78	NA
Direct[1]	0.04	0.09	1%
Indirect[2]	0.61	0.81	12%
Guam Civilian Growth	0.84	1.88	16%
Total Future Flows (2028)	**6.59**	**14.26**	**29%**

Notes: [1]Direct includes only "project, or cantonment/family housing area, and new incoming Marine Corps personnel.
[2]Indirect includes non-project, other DoD, and induced impacts, including ACE. NA = not applicable.

Table 4.4.14-2. Agaña WWTP Wastewater Flows

Wastewater Impact	*Total Monthly Average Flow (MGd)*	*Total Monthly Maximum Flow (MGd)*	*% Increase Average Flow from Baseline*
Baseline	5.4	10.8	
Notional Increase	2.11	3.67	
Direct[1]	1.23	1.92	23%
Indirect[2]	0	0	0%
Guam Civilian Growth	0.88	1.75	16%
Total Future Flows (2028)	**7.51**	**14.47**	**39%**

Notes: [1]Direct includes only "project, or cantonment/family housing, and new incoming Marine Corps personnel.
[2]Indirect includes non-project, other DoD, and induced impacts, including ACE.

The existing wastewater collection system at Barrigada cannot handle the increase in demand from the proposed action. The proposed wastewater collection system for Alternative D, as described in Section 2.4.4.4, has been developed to be independent of the existing Navy Barrigada wastewater collection system and should be able to handle the projected flows from the proposed action. The proposed wastewater collection system would extend off-base and connect to the GWA collection and conveyance system on Route 10. Proposed off-base improvements would include refurbishment of an existing GWA pump station, or construction of a new pump station and a new force main to tie into the GWA collection system along Route 8. Ownership of new off-base infrastructure connecting the proposed wastewater system to the GWA collection system would be given to the GWA.

The Agaña WWTP and the Northern District WWTP cannot meet permit requirements for treatment of the projected maximum monthly wastewater flows derived from the proposed action and other sources. Therefore, they are unable to meet the current treatment requirements. Increasing the wastewater flow to a non-compliant treatment plant by the amounts shown in Tables 4.4.14-1 and 4.4.14-2 would be a significant impact. The DoD would assist GWA in identifying funding from federal agencies such as the DoD OEA, the DOI, and others for upgrades to the Northern District WWTP. Wastewater flow to Agaña WWTP from the preferred alternative is deemed negligible. Under this alternative, the increased wastewater flows to Agaña WWTP from the proposed action would be from indirect sources, from induced civilian growth, and would be less than 1% of the total projected flow. Therefore, consistent with impact assessment criteria in the SEIS, a less than significant impact to the wastewater flow to Agaña

WWTP is anticipated from the proposed action. It should be noted that the construction workforce would likely be located within the Northern District WWTP area under the preferred alternative.

The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.

The required improvements to treatment from the newly issued permits need to have an agreed upon timeline for implementation. Obtaining funding, performing design and construction, and bringing the new portions of the WWTP into operational status is a time-consuming endeavor and must be given a reasonable length of time for proper implementation. Ultimately, this is dependent upon the GWA and the USEPA reaching an agreement on a suitable implementation timeline.

The GWA southern WWTPs (Agat-Santa Rita WWTP, Baza Gardens WWTP, Umatac-Merizo WWTP, and Inarajan WWTP) would not receive direct DoD wastewater flows from the proposed action, but would be indirectly affected to a small degree by the proposed action from indirect wastewater flows from the induced civilian growth as well as forecast organic civilian growth in the region. The increased wastewater flow from indirect impacts from the proposed action to the four southern GWA WWTPs is estimated to total a maximum monthly flow of 0.02 MGd (0.08 MLd); a small percentage of the total capacity of the plants. Upgrades to the GWA southern WWTPs are requirements under the 2011 Court Order, and planning and design are in progress. Due to the small flow increases from the proposed action and the induced civilian growth, the impact to the southern WWTPs would be less than significant.

During construction of the proposed action less than significant impacts would result from potential service outages and sewage spills. The impacts for Alternative D are similar to those assessed for Alternatives A, B, C, and E. These impacts would be minimized through compliance with the DON's utilities outage procedures and implementation of BMPs such as; coordination with utility providers and permitting agencies, and prior to excavation identifying existing underground utility lines through utility research, toning, or potholing. Other potential BMPs may include constructing sewers during low flow periods, by-pass pumping, and having pump trucks on stand-by.

Other long-term operational impacts related to implementing the proposed action would include increases to power needs; operator staffing and training; sludge handling; fats, oils, and grease; and industrial wastewater. Potential mitigation measures to operation impacts may include the Marine Corps contributing to the GWA revenues for operations and maintenance as a new rate paying customer; payments of service development charges; the implementation of an on-base program to control fats, oils, and grease with grease traps; and pretreating industrial wastewater with oil-water separators or other applicable pretreatment systems. Thus, long-term, direct impacts during operations would be mitigated to less than significant.

The significance of wastewater impacts for Alternative D would be significant but mitigable for both the Agaña and Northern District WWTPs and their collection systems.

Solid Waste

The solid waste infrastructure for Alternative D as described in Section 2.4.4.4 has been developed to meet the requirements for the proposed action. The environmental consequences for the solid waste infrastructure associated with Alternative D are similar as for Alternative A, as provided in Section 4.1.14.2 under Solid Waste. In the case of Barrigada; however, the C&D debris would mainly consist of concrete (from the planned demolition of the existing buildings at the former Nimitz Golf Course) that would be crushed and used as lower-grade aggregate.

The new Layon Landfill is designed to account for the level of MSW projections from the 2010 Final EIS. Therefore, it has the capacity to accommodate the projected MSW for the reduced levels of the current proposed action. The reduction in the generation of solid waste under the current proposed action versus the 2010 proposed action is a beneficial effect, as this increases the life of the existing Layon Landfill. Therefore, there would be less than significant long-term direct and indirect impacts to the solid waste resources on Guam for Alternative D, both during construction and operation.

The DON proposes to explore ways to resolve key solid waste issues, specifically the status of the Naval Base Guam Landfill permit and handling of special wastes not accepted at Layon Landfill, through the Solid Waste Working Group that was established with USEPA and GEPA on July 24, 2014. During the September 19, 2014 meeting of the Solid Waste Working Group, GEPA indicated that they will formally respond to DON correspondence with regards to issues relative to the Naval Base Guam Landfill. The Layon Landfill and the permitted private hardfill facilities are operating within their regulatory requirements. The proposed action would be in compliance with all applicable GEPA solid waste permit terms and conditions that routinely include specific measures to protect human health and the environment. All other projects on Guam would utilize permitted solid waste management and disposal facilities.

Information Technology and Communications

The proposed IT/COMM infrastructure for Alternative D, as described in Section 2.6, has been developed to meet the requirements for the proposed action. For the proposed cantonment area at Barrigada, there is no existing IT/COMM infrastructure; therefore, there would be no impacts to those users.

For the proposed housing area at Barrigada, there are several existing DoD IT/COMM lines, but no commercial lines. The proposed housing area has been designed around those existing lines using the best available information on their locations. It is possible that these lines could be impacted during construction. Should the locations of these existing lines be different from available information, the lines might require relocation or the proposed development might require revisions to avoid the existing lines.

Additional inter-base IT/COMM connectivity would be required, as described in Section 2.6. This includes the connection between AAFB and the existing Tata cable landing facility in southern Guam, which would require new rights of way along some southern roads, as well as the access road to the Tata facility.

Therefore, long- and short-term direct impacts to existing IT/COMM infrastructure would be less than significant both during construction and in operation.

4.4.15 Socioeconomics and General Services

4.4.15.1 Affected Environment

The affected environment for socioeconomics and general services on Guam is presented for the entire island of Guam and does not vary by alternative. Because the affected environment does not vary by alternative, it is only presented one time, under Alternative A. A full description of the affected environment for socioeconomics and general services is presented in Section 4.1.15.

4.4.15.2 Environmental Consequences

The socioeconomics and general services impacts under Alternative D would be island-wide, direct and indirect, short- and long-term, and would be the same as described under Alternative A in Section 4.1.15. The population change associated with Alternative D would not likely put excessive strain on Guam's public services and permitting agencies, and the estimated increases in GovGuam tax revenues would likely compensate for any increased demand that would occur. The economic impacts would be beneficial, leading to increased employment and standards of living, and impacts to Guam's housing stock and availability would not bring about reactionary development, which could have otherwise lead to dislocations in the housing market. There is a potential for sociocultural impacts to occur, but the magnitude of the impacts could vary substantially based on policy and program choices yet to be made on how to address them.

4.4.16 Hazardous Materials and Waste

4.4.16.1 Affected Environment

The current DoD ROI on Guam for hazardous materials and waste in this section includes the Barrigada property proposed for development of the cantonment, the former Nimitz Golf Course and the areas affected by off-site utilities development and DoD school expansions (see Section 2.4.4.6 in Chapter 2). There currently are no hazardous materials storage or hazardous waste accumulation sites located at Barrigada.

Contaminated Sites

Installation Restoration Program Sites

One IRP site, Naval Computer and Telecommunications Station Western Pacific Site 14: Barrigada Golf Course landfill is located on the Barrigada parcel proposed for development under Alternative D (Figure 4.4.16-1). This site is not currently active and land use restrictions may exist for the site. This site is described in detail in the 2010 Final EIS (Volume 9: Appendices, Appendix G: EIS Resource Technical Appendix, Chapter 3: Hazardous Materials and Waste Resources, Table 3.6-3 Summary of Active Navy Environmental Restoration Sites in Central Guam, pages G-3-44 to G-3-49). In addition, the Barrigada Substation is located adjacent to the area proposed for development of cantonment/family housing under this alternative. This site is also a restricted/active IRP site.

Military Munitions Response Program

No MMRP sites were identified on the Barrigada/Nimitz Golf Course parcel proposed for development of cantonment/family housing under Alternative D.

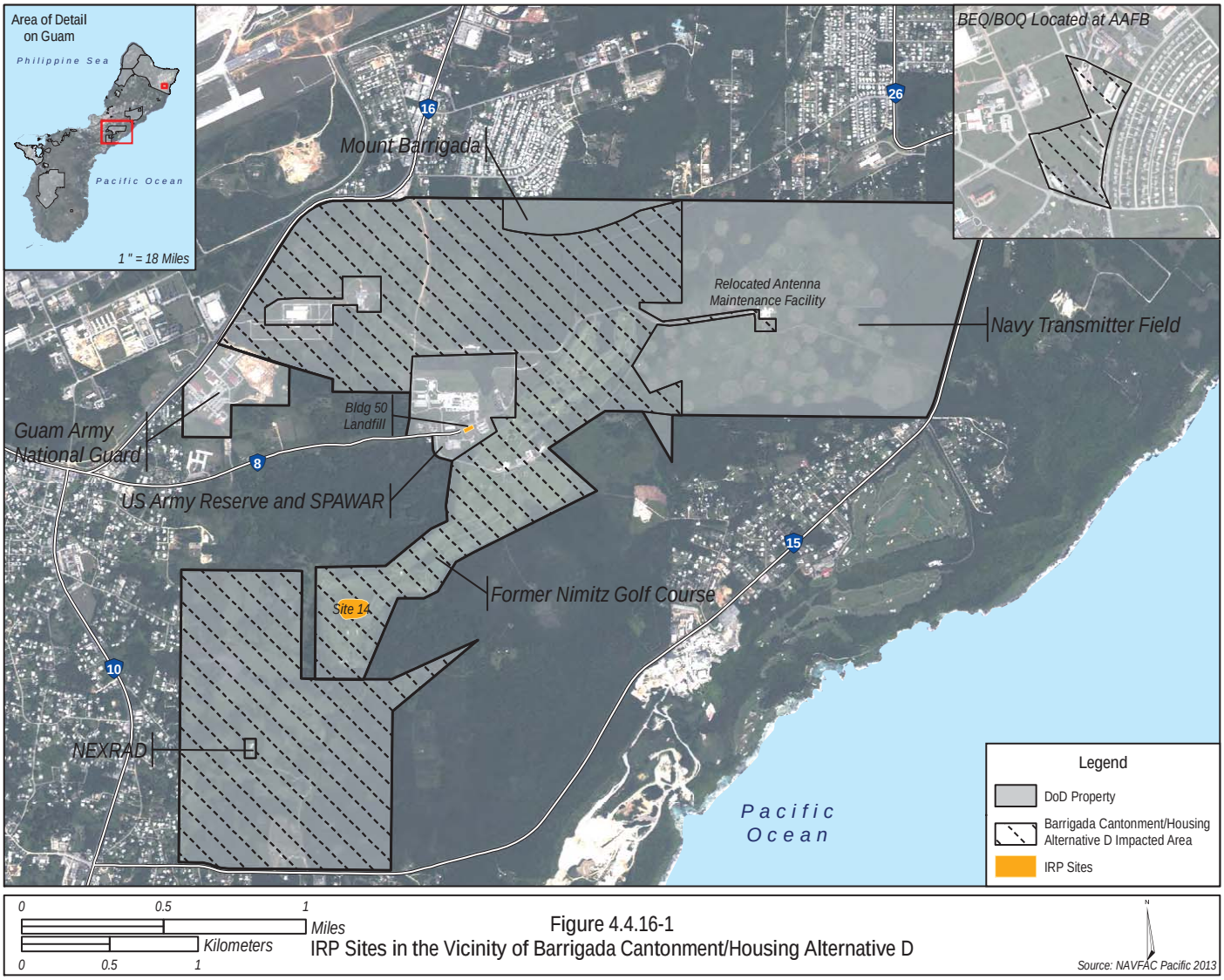


Figure 4.4.16-1
IRP Sites in the Vicinity of Barrigada Cantonment/Housing Alternative D

Toxic Substances Management

Currently, there are a few structures located on the portion of Barrigada proposed for development of the cantonment/family housing under this alternative. Any structure constructed prior to 1978 may contain LBP, ACM, and PCBs. Elevated levels of lead and PCBs associated with IRP sites may be present in site soils.

According to USEPA, the parcel is located in an area classified as Zone 1 for Radon, indicating average indoor radon levels of greater than 4 pCi/L.

4.4.16.2 Environmental Consequences

Short-term construction impacts and long-term operational impacts to hazardous materials and waste under this alternative would be similar to those described under Section 4.1.16.2 of this SEIS. Hazardous materials and hazardous waste would be managed as described for AAFB, NWF, and Finegayan in Section 3.16 of this SEIS. Therefore, implementation of Alternative D would result in less than significant direct and indirect impacts to hazardous materials and waste.

4.4.17 Public Health and Safety

4.4.17.1 Affected Environment

Notifiable Diseases

The Affected Environment for notifiable diseases for Alternative D is the same as discussed in Section 4.1.17.1 for Alternative A.

Mental Illness

The Affected Environment for mental illness for Alternative D is the same as discussed in Section 4.1.17.1 for Alternative A.

Operational Safety

To protect the general public from intentional or accidental entry onto Barrigada, locked or manned gates are used where vehicle access is provided and a series of signs warning unauthorized personnel not to enter the area are posted along the perimeter of the installation. Unauthorized personnel are not allowed on the installation at any time.

Barrigada is largely used to support DoD communication high frequency transmitting activities. There is a large antenna field developed around an active transmitter facility. In addition, the Air Force Barrigada property is used to accommodate a NEXRAD weather facility. An EMR hazard safety zone has been established around the transmitter antennas to ensure the safety of workers and the public.

Barrigada also supports field training exercises, military operations on urban terrain training in unoccupied housing units, and EOD/land demolition training. Open areas (former transmitter sites) provide command and control and logistics training; bivouac, vehicle land navigation, and convoy training; and other field activities. Land demolition training for location, excavation, identification, and neutralization of buried land mines involves teams locating inert land mines or Improvised Explosive Devices and then designating the target for destruction. These operations are insulated to an interior location of the installation and are sporadic based on variable training conducted by various branches of the military. Activities are conducted in accordance with SOPs to ensure the safety of both training participants as well as the public.

Environmental Health Effects

Noise

There are no current noise management issues associated with the existing operations at Barrigada. Details regarding current noise conditions at Barrigada are provided in Section 4.4.4.1.

Water Quality

Several water wells are situated within the Barrigada property boundary or are immediately adjacent to the installation. These wells each have a mandated 1,000-foot (305-m) buffer identified as a wellhead protection zone. Within this zone, future activities and development are restricted to ensure contaminants are not introduced in these areas, thus protecting the integrity of the island's freshwater aquifers. Guam's freshwater aquifers are susceptible to contamination from surface activities. GEPA requires treatment to ensure water quality meets safe drinking water standards. Section 4.4.2.1 provides details regarding current quality of potable water sources.

Hazardous Substances

Current management practices and contingency plans for the use, handling, storage, transportation, and disposition of hazardous substances associated with Barrigada ensure that exposure to the environment and human contact is minimized.

The IRP focuses on cleaning up releases of hazardous substances that pose risks to the public and/or the environment. The MMRP focuses on identifying and removing MEC. One IRP site is situated within Barrigada. No MMRP sites have been identified on Barrigada. The IRP site includes Naval Computer and Telecommunications Station Western Pacific Site 14 (Barrigada Golf Course Landfill) situated north of the NEXRAD facility. Materials disposed at Site 14 include municipal refuse, possibly waste oil from motor pool activities, and debris generated during construction of the golf course (e.g., trees, shrubs, dirt, rocks).

For Public Works Center Site 14, a Site Investigation was conducted and further investigation was recommended to assess the nature and extent of the identified contamination. The hazardous materials and waste section of this SEIS (Section 4.4.16) provides additional detail for the status of IRP and MMRP sites.

Unexploded Ordnance

The presence of UXO within Barrigada is not known. However, Guam was an active battlefield during WWII. As a result of the occupation by Japanese forces and the assault by Allied/American forces to retake the island, unexploded military munitions may still remain.

Traffic Incidents

The nearest high crash frequency location in the vicinity of the proposed cantonment and housing area at Barrigada is the intersection of Routes 8, 10, and 16 (approximately 1 mile [1.6 km] west of Barrigada). This intersection has been identified by GPD as an intersection with a high frequency of traffic incidents. However, traffic improvements were completed in 2012 in an effort to improve vehicle safety, these improvements included installation of a new traffic signal system that reduced congestion and channelized traffic.

4.4.17.2 Environmental Consequences

Potential direct and indirect impacts on public health and safety from implementation of Alternative D would be similar to those discussed under Alternative A.

Notifiable Diseases

Potential increases in notifiable diseases for Alternative D would be the same as discussed in Section 4.1.17.2 for Alternative A.

Mental Illness

Potential increases in mental illness for Alternative D would be the same as discussed in Section 4.1.17.2 for Alternative A.

Operational Safety

To protect the general public from intentional or accidental entry onto Barrigada, locked or manned gates would continue to be used where vehicle access is provided and a series of signs warning unauthorized personnel not to enter the area would remain posted along the perimeter of the installation. Unauthorized personnel would not be allowed on the installation at any time.

The primary operational activities that would occur within the cantonment and housing area include:

- Administrative, supply, service, and maintenance functions for operational units.
- Base support functions.
- Unaccompanied personnel housing and related support functions (e.g., school, child development center, youth center).
- Training functions (i.e., classroom instruction and non-live fire training).
- Community support functions.

Specific and documented procedures would be in place to ensure the public is not endangered by operations and training activities. Therefore, Alternative D would result in no direct or indirect impacts on public health and safety (resulting from operations and training activities).

Electromagnetic Safety

Use of Barrigada to support cantonment and housing requirements for relocated Marines would be conducted so that new developments are consistent with established EMR hazard zones. Exposure to electromagnetic emissions would be limited by restricting access to emitters through the use of security fencing, posting warning signs, or locking out unauthorized persons in areas, where practical. Because electromagnetic emission sources would be operated in accordance with applicable safety standards and the public would be excluded from entering areas where emission sources are located, potential long-term impacts from electromagnetic emissions on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to electromagnetic emissions is anticipated.

Construction Safety

Because a health and safety program would be implemented for construction activities and the public would be excluded from entering construction areas, potential short-term construction impacts on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to construction activities is anticipated.

Environmental Health Effects

Noise

Potential short-term construction and long-term operational noise emissions associated with Alternative D would be similar to those discussed under Alternative A. Enforcement of OSHA guidelines for hearing protection for workers would be the responsibility of the construction contractor. The public would be excluded from entering construction areas. Therefore, short-term construction noise impacts on public health and safety would be less than significant. Long-term operational noise from activities occurring within the cantonment and housing areas would be similar to current noise levels. Therefore, overall direct or indirect impacts associated with noise to human health and safety would be less than significant.

Water Quality

Potential water quality impacts associated with Alternative D would be similar to those discussed under Alternative A. Groundwater withdrawal would likely increase. However, sustainability practices would be implemented to reduce the amount of groundwater needed. The resulting total annual groundwater production would be less than the sustainable yield and monitoring of groundwater chemistry would identify any emerging issues to ensure no harm to the water supply. Water wells on and adjacent to Barrigada have a mandated 1,000-foot (305-m) buffer identified as a wellhead protection zone. Proposed development and operational activities would be conducted in accordance with GEPA guidance and BMPs to minimize the potential for contaminants to be introduced in these areas. Therefore, direct and indirect public health and safety impacts from long-term increased demand on potable water and potential water-related illnesses would be less than significant.

Hazardous Substances

Potential direct impacts from hazardous substances for Alternative D would be similar to those discussed under Alternative A. The use, handling, storage, transportation, and disposition of hazardous substances would be conducted in accordance with applicable hazardous material and waste regulations, and established BMPs and SOPs to ensure the health and safety of workers and the general public is maintained.

IRP investigations and/or remediation activities, as necessary, would continue in an effort to clean up past releases of hazardous substances and receive regulator concurrence that necessary actions have been completed to ensure the safety of the public. Site 14 is within the area potentially available for development of cantonment and housing. However, no building construction is proposed within the landfill area and no off-site population is nearby. Therefore, no health hazards have been identified. Because hazardous substance management and IRP investigative/cleanup activities would be conducted in accordance with applicable regulations and established BMPs and SOPs, no direct or indirect impacts on public health and safety are anticipated.

Unexploded Ordnance

Potential direct impacts from UXO for Alternative D would be similar to those discussed under Alternative A. With the exception of public access provisions outlined through the 2011 PA process (see Section 4.4.10, Cultural Resources), the general public would be excluded from entering construction zones and training areas. To reduce the potential hazards related to exposure to MEC, ESS documentation would be prepared that outlines specific measures that would be implemented to ensure the safety of workers and the public. BMPs would be implemented to identify and remove potential MEC items prior to the initiation of ground-disturbing activities. UXO personnel supervision would occur during earth-

moving activities and MEC awareness training would be provided to construction personnel involved in grading and excavations prior to and during ground-disturbing activities. In addition, the DON provides MEC awareness training to GovGuam and other public representatives allowing access to project sites to facilitate surveys or collection of natural resources or items of cultural significance prior to conducting vegetation clearance. Because UXO would be identified and removed prior to initiating construction activities and construction personnel would be trained as to the hazards associated with UXO, potential direct impacts from encounters with UXO would be minimized and less than significant.

Traffic Incidents

Potential long-term traffic incident increases for Alternative D would be similar to those discussed under Alternative A. The overall long-term potential for increased traffic incidents on Guam is small (5% increase [see Section 4.1.17.2]). A high crash frequency intersection is located approximately 1 mile (1.6 km) from the Barrigada Main Gate entrance (Route 8/10/16 intersection). Traffic improvements were completed at this intersection in 2012 in an effort to improve vehicle safety. Improvements included installation of a new traffic signal system that reduced congestion and channelized traffic. New personnel would be alerted to the traffic hazards at this multi-intersection in an effort to raise awareness of the hazards of driving in the area. Because the overall potential long-term increase in the number of traffic accidents as a result of the increase in personnel would be minimal, there would be a less than significant impact on the health and safety of the citizens of Guam (from traffic incidents).

4.4.18 Environmental Justice and the Protection of Children

4.4.18.1 Affected Environment

As described in Alternative A, Section 4.1.18, the affected environment for environmental justice and protection of children analysis is the entire island of Guam. Therefore, the affected environment for Alternative D is the same as for Alternative A. In addition, Alternative D is located in the northern area of the island, the same region as Alternative A. The villages of Dededo and Yigo are within this region.

4.4.18.2 Environmental Consequences

Potential impacts to environmental justice populations under Alternative D would be to noise, recreation, socioeconomics and general services (including health services), and public health and safety.

Noise

The potential impacts would be the same as Alternative A.

Recreation

Impacts are generally island-wide and would be the same as described for Alternative A.

Socioeconomics and General Services

Impacts are generally island-wide and would be the same as described for Alternative A, as would the identified measures to mitigate impacts.

Public Health and Safety

Impacts are generally island-wide and would be the same as described for Alternative A, as would the identified measures to mitigate impacts.

4.5 FINEGAYAN CANTONMENT/ANDERSEN AIR FORCE BASE HOUSING - ALTERNATIVE E

Alternative E is the preferred alternative. Under this alternative, the proposed development and operation of a cantonment area and family housing would occur at Finegayan and AAFB, respectively. Details about this alternative, which was added for the Final SEIS in response to public and agency comments on the Draft SEIS, are provided in Section 2.4.4.5 and the proposed sites are illustrated in Figures 2.4-12, 2.4-13, and 2.4-14.

4.5.1 Geological and Soil Resources

4.5.1.1 Affected Environment

Under Alternative E, the affected environment for geological and soil resources is as described for Alternative A and Alternative C (Sections 4.1.1 and 4.3.1, respectively, of this SEIS). In addition, an extensive discussion of the affected environment for geological and soil resources on Guam is provided in the 2010 Final EIS (Volume 2, Chapter 3: Geology and Soils Resources, Section 3.1.2.2 Finegayan, pages 3-15 to 3-16 and Section 3.1.2 North, pages 3-14 to 3-15). In summary, old (Barrigada) and young (Mariana) limestones comprise the bedrock at Finegayan and AAFB (Figures 4.1.1-1 and 4.3.1-1, respectively, of this SEIS). Based on available topographic and field data, there are 34 features that have been preliminarily identified as sinkholes/depressions that may contain sinkholes in the project area (Finegayan has 28 features and AAFB has 6 features identified). The soils are Guam Urban Land Complex and Guam Cobbly Clay Loam at Finegayan and Urban Land Complex at AAFB; none of the soils in the proposed Finegayan and AAFB project areas are identified as prime farmland by the USDA (Figures 4.1.1-2 and 4.3.1-2, respectively) (Young 1988). With respect to geologic hazards, conditions under Alternative E are similar to those described for Alternative A in Section 4.1.1.1; three minor faults are mapped within the Finegayan footprint and none are mapped within the AAFB footprint (see Figures 4.1.1-1 and 4.3.1-1, respectively).

In addition, the geological and soils affected environment for projects common to all alternatives (i.e., school expansions and off-site utilities) would be similar or identical to those described for Alternative A. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for geological and soil resources, but it would reduce some potential impacts to geological and soil resources that were determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, which is described in the analysis of environmental consequences for Alternative E below.

4.5.1.2 Environmental Consequences

Potential geology and soil impacts addressed in this section are limited to elements of the proposed action that could affect onshore landforms or that could be affected by geologic hazards. Potential soil contamination issues are addressed in Section 4.5.16.2 of this SEIS (Hazardous Materials and Waste).

Construction

Construction of the new cantonment/family housing, associated support facilities, and roads under Alternative E would include the same activities as described for Alternative A. Grading for construction of the cantonment/family housing areas and associated infrastructure (comprising the Finegayan and AAFB components) would include 3,732,871 yd^3 (2,853,984 m^3) of cut (excavation) and 2,958,469 yd^3 (2,261,911 m^3) of fill, resulting in a net of 774,402 yd^3 (92,072 m^3) of cut material available for use as needed.

While Alternative E would involve the largest volume of excavation of any of the five action alternatives (Alternative C would involve the least), it still does not include any substantial grade changes such as steep hills or canyons that would be leveled or filled. Similar to Alternatives A and C, only relatively minor changes in grade are anticipated to provide a buildable surface for construction of buildings, parking lots, and roadways associated with Alternative E. Because construction for Alternative E does not involve major elevation changes and would not substantially alter the surrounding landscape, affect important geologic features, or diminish slope stability, there would be less than significant direct, long-term impacts to topography and slope stability.

Under Alternative E, the same construction activities would take place as for Alternatives A and C, in similar geologic, soil, and seismic conditions. The soil types that would be disturbed would not be prime farmland as identified by the USDA. The same BMPs described for Alternative A would be implemented for Alternative E. Therefore, under Alternative E, the construction impacts would be similar to Alternative A and Alternative C: there would be less than significant direct, short-term impacts to soils from erosion and no direct or indirect impact to agricultural soils. Given compliance with 22 GAR Chapter 10 § 10106F, there would be no adverse impacts to sinkholes and direct short-term impacts to sinkholes would be less than significant. In addition, direct and indirect short-term impacts associated with geologic hazards would be less than significant.

Under Alternative E, construction of the utility and school expansions that are common to all alternatives would comprise the same activities, and would occur in the same geologic, soil, and seismic conditions as for Alternative A and C. The same BMPs described for Alternative A would be implemented for Alternative E. Therefore, under Alternative E, the construction impacts of these components would be similar to Alternatives A and C and would be less than significant.

Operation

Under Alternative E, the same residential, recreational, commercial, and administrative uses would take place in the Finegayan and AAFB project areas, as Alternative A and C, under similar geologic, soil, and seismic conditions. No prime farmland is identified within the Alternative E project footprint, so there would be no direct or indirect impact to agricultural soils as a result of Alternative E operations. The same erosion minimization measures, sinkhole BMPs and seismic design requirements described for Alternative A would apply to Alternative E. Therefore, with the operation phase of Alternative E, there would be no direct or indirect long-term impacts to topography and slope stability, and less than significant direct long-term impacts to soils from erosion. Given compliance with 22 GAR Chapter 10 § 10106F, there would be no adverse impacts to sinkholes. This would minimize potential geologic hazards associated with sinkholes and reduce potential direct long-term impacts to sinkholes to less than significant. Direct and indirect long-term impacts associated with geologic hazards would be less than significant.

Under Alternative E, operation of the utility and school expansions that are common to all alternatives would comprise the same activities, and would occur in the same geologic, soil, and seismic conditions as for Alternatives A and C. The same BMPs described for Alternative A would be implemented for Alternative E. Therefore, under Alternative E, the operational impacts of these components would be similar to Alternatives A and C and would be less than significant.

4.5.2 Water Resources

4.5.2.1 Affected Environment

Under Alternative E, the affected environment for water resources is as described for Alternative A and Alternative C (Sections 4.1.2 and 4.3.2, respectively). In addition, an extensive discussion of the affected environment for water resources on Guam is provided in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.1.2.2: Finegayan, page 4-26 and Section 4.1.2.1: Andersen AFB, pages 4-25 to 4-26).

Surface Water

There are no surface water resources in the Finegayan and AAFB project area or the utility corridor to AAFB. Existing impervious areas on the Finegayan project area amount to approximately 60 acres (24 ha), or about 6% of the proposed Finegayan impacted area of 945 acres (382 ha). Existing impervious areas on the AAFB project area amount to approximately 357 acres (145 ha), or 85% of the proposed AAFB impacted area of 420 acres (170 ha).

Groundwater

The Finegayan project area overlies the Finegayan and Agafa-Gumas basins of the NGLA and the AAFB project area overlies the Andersen Basin of the NGLA. The circumstances concerning the groundwater model developed by the USGS, the current well production, and the existing GWA interceptor sewer system are the same as described under Alternative A in Section 4.1.2.1 of this SEIS.

Nearshore Waters

Nearshore waters at Finegayan include Haputo Beach and nearshore waters at AAFB include Tarague Beach and the Pati Point Marine Preserve; these waters are classified as having M-1 water quality, the use of which is primarily recreational. The Finegayan and AAFB project area would be served by the Northern District WWTP, which discharges into the Philippine Sea near Tanguisson Beach (see description under Alternative A in Section 4.1.2.1 of this SEIS).

Wetlands

As indicated in the 2010 Final EIS, no wetlands were identified at the Finegayan or AAFB project areas.

4.5.2.2 Environmental Consequences

Construction

General construction impacts to water resources would be similar to those described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-84 to 4-88) and under Alternative A in Section 4.1.2.2 of this SEIS. Construction impacts associated with the proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities common to all cantonment/family housing alternatives would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be no impacts to surface water, nearshore waters, and wetlands and less than significant short-term direct impacts to groundwater for these common elements.

In addition, there would be construction activities associated with the proposed Alternative E and the utility corridor to AAFB under Alternative E. Similar to Alternative A, Alternative E would occur in an area that does not contain waters of the U.S. but would comply with the Construction General Permit as described under Alternative A.

Construction under Alternative E would result in the potential for short-term increases in stormwater runoff and erosion. However, through compliance with the Construction General Permit and Program SWPPP and implementation of a site-specific SWPPP and associated erosion control, runoff reduction, and sediment removal BMPs (see Table 4.1.2-2), these effects would be minimized and off-site transport of stormwater runoff would be unlikely except during extreme weather events (i.e., typhoons). Specifically, the site-specific SWPPP would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flow rate of runoff and thereby minimize transport of suspended sediment through settling and promote infiltration of runoff.

Surface Water

No buildings/structures would be constructed in the 100-year or 500-year flood zones and no surface waters are located within or near the proposed construction areas under Alternative E. Given compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely. Therefore, construction activities associated with Alternative E would result in no impacts to surface waters.

Groundwater

Construction activities under Alternative E would include stormwater runoff protection measures that would also serve to protect groundwater quality. By adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific water resource protection requirements, there would be a reduction in stormwater pollutant loading potential and thus a reduction in pollution loading potential to the underlying groundwater sub-basins of the NGLA. As described under Alternative A, an environmental and hydrogeologic assessment for the selected alternative would be performed for sinkholes within the project development footprint to ensure adverse effects to groundwater resources would not occur. Impacts associated with the induced civilian growth and construction/DoD workforce demand on potable water and the construction of the proposed approximately 11 new wells at AAFB would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS.

Potential increases in the rate of sewage spills associated with the induced civilian growth and construction/DoD workforce would result in significant indirect impacts to groundwater quality as described under Alternative A in Section 4.1.2.2 of this SEIS. Mitigation for these impacts would be the same as described in Section 4.1.2.2 for Alternative A.

Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs), the environmental and hydrogeologic assessment for sinkhole protection (if encroachment is unavoidable), siting and construction of wells in accordance with GEPA regulations, minimal increase in water demand or withdrawal from the NGLA during the construction phase, and DoD assistance in identifying funding to upgrade sewer lines, construction activities associated with Alternative E at Finegayan and AAFB would result in less than significant short-term direct impacts to groundwater.

Nearshore Waters

General construction impacts to nearshore waters would be similar to those described under Alternative A in Section 4.1.2.2 of this SEIS. The Finegayan cantonment project area would be located between 0.5 and 1 mile (0.8 and 1.6 km) from nearshore waters, and the AAFB family housing project area would be located 0.5 mile (0.8 km) from nearshore waters. Given compliance with the Construction General Permit

and implementation of a Program SWPPP and site-specific SWPPP, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely (see discussion of BMPs under *Construction*). In addition, vegetative cover between the construction area and the edge of the steep cliffline and the shoreline would provide an additional buffer and protection from stormwater runoff or sediment reaching nearshore waters. Given adherence to the provisions of the Construction General Permit and implementation of BMPs, it is expected that stormwater runoff, sediment, or other pollutants would not discharge to nearshore waters.

Induced civilian and construction/DoD workforce growth during construction of the cantonment/family housing facilities under Alternative E would increase demand for wastewater treatment at the Northern District WWTP and disposal of generated wastewater. Due to the reduced population projection and related smaller increase in demand under the 2012 Roadmap Adjustments, this increase in wastewater discharge from the Northern District WWTP would be less than under the No-Action Alternative. However, as discussed in Section 4.1.14, Utilities in this SEIS, upgrades to the Northern District WWTP are already needed for the plant to achieve compliance with the current NPDES permit. Increasing the wastewater discharge from a non-compliant treatment plant could result in significant indirect impacts to nearshore waters during the period of non-compliance. The impacts to nearshore waters resulting from implementation of Alternative E would be considered significant and would be similar to significant impacts described for the other four cantonment/family housing alternatives. Mitigation for these impacts would be the same as described in Section 4.1.2.2 for Alternative A.

Therefore, with the mitigation to upgrade the Northern District WWTP treatment systems, the impact to nearshore waters could be beneficial in the long-term because the total volume of wastewater discharge from the Northern District WWTP would receive a higher level of treatment. However, until the WWTP upgrades are completed there would be an indirect and unmitigable significant impact to nearshore waters during construction.

Wetlands

No wetlands are located in or near the construction areas associated with Alternative E. Therefore, construction activities associated with Alternative E would result in no impacts to wetlands.

Operation

Alternative E would incorporate a LID approach in the final planning, design, and construction of the stormwater management system as described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-85 to 4-87) and under Alternative A in Section 4.1.2.2 of this SEIS. Operation impacts associated with the proposed approximately 11 new wells at AAFB, school expansions, and off-site utilities common to all cantonment/family housing alternatives would be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be no impacts to surface water, nearshore waters, and wetlands and less than significant direct and indirect long-term impacts to groundwater for these common elements.

The proposed stormwater management system infrastructure improvements included as part of the proposed action would incorporate LID measures and BMPs for compliance with local and federal requirements that are designed to minimize potential impacts to downstream development, sensitive water resources, and ecology, as described under Alternative A in Section 4.1.2.2 of this SEIS. Alternative E would also be implemented in accordance with all applicable orders, laws, and regulations including the preparation and implementation of a SWPPP, SWMP, and SPCC plan that would control runoff and minimize potential leaks and spills.

Under Alternative E, the total impervious area on the Finegayan cantonment project area would increase by approximately 280 acres (113 ha) or 24% due to new facilities, and the total impervious area on AAFB housing would decrease by approximately 40 acres (16 ha) or 10%. The increase in impervious area for the Finegayan cantonment project area would result in an associated increase in stormwater runoff volume for each of the design storm events. Alternative E would result in increased stormwater runoff of 232 acre-feet (286,000 m^3) from the 25-year design storm and 338 acre-feet (471,000 m^3) from the 100-year design storm at Finegayan. At AAFB, stormwater runoff would decrease by 109 acre-feet (135,000 m^3) from the 25-year design storm and 158 acre-feet (195,000 m^3) from the 100-year design storm. The project design would include vegetated swales for conveyance and treatment and detention/retention ponds capable of capturing, storing, and treating additional runoff from the 25-year design storm (see Appendix F for examples of LID applications that would be used and conceptual design of stormwater runoff routing and pond locations). As part of the initial design, the project area was delineated into sub-basins with stormwater conveyance systems to route discharges to appropriately sized detention basins. For each sub-basin, water quality treatment strategies were selected based on the effectiveness of BMPs to treat identified pollutants of concern from proposed land uses within that sub-basin. The selected water quality treatment strategies would achieve reductions of non-point source pollutants to meet the same water quality requirements as identified under Alternative A in Section 4.1.2.2 of this SEIS. In addition, DON would develop and implement a "LID BMP O&M Inspection Checklist" consistent with the 2006 CNMI Guam Stormwater Management Manual to monitor and ensure the effectiveness of LID features during operation. Any deficiencies would be reported to and addressed by the future Public Works Department of the Marine Corps Base Guam.

The final Grading/Drainage/LID Study, dated July 2013, would be provided to the design team for guidance and implementation during design and construction. The designs performed by these contractors would be subject to review by DoD professionals and technical consultants to ensure proper implementation both during design and verification during construction.

Surface Water

No surface waters are located in or near the Alternative E project area and the implementation of an appropriate and comprehensive stormwater management plan utilizing a LID approach would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event. Therefore, Alternative E would result in no impacts to surface waters.

Groundwater

Under Alternative E, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would also serve to protect groundwater quality and recharge. Specifically, implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that the stormwater runoff flowing into infiltration basins and recharging the aquifer would be of acceptable quality.

Compared to Alternative A, there would be less removal of secondary limestone forest (i.e., approximately 854 acres [346 ha] for Alternative E vs. 1,000 acres [400 ha] for Alternative A) and less area would be converted to impervious area (i.e., approximately 240 acres [97 ha] for Alternative E vs. 273 acres [110 ha] for Alternative A). Similar to Alternative A, these changes in land cover and impervious area under Alternative E would also result in minor changes to groundwater recharge rates. However, these types of changes in land cover and impervious area were accounted for during the development of a conceptual level of design for grading, drainage, and LID measures, and projected

changes in recharge rates would be managed through updating the USGS numerical groundwater model to determine modifications to groundwater pumping, as described under Alternative A. Increased groundwater withdrawal would also be the same as described under Alternative A in Section 4.1.2.2 of this SEIS. There would be short-term, localized significant impacts to the affected basin within the NGLA but less than significant impacts to the overall NGLA. There would be significant but mitigable impacts to groundwater quality from the increased flow through the deteriorating GWA interceptor sewer system. Potential mitigations would be the same as described for Alternative A in Section 4.1.2.2 of this SEIS.

Given stormwater runoff protection measures (i.e., implementation of LID and pollution prevention plans); implementation of water conservation measures; groundwater demand from the NGLA that would be substantially less than the sustainable yield; improved management of the NGLA through use of the numerical groundwater model; DoD assistance in identifying funding through the EAC process for an updated and expanded monitoring network; and other potential mitigation measures discussed above, operations associated with Alternative E would result in less than significant impacts to the overall NGLA; short-term, localized significant but mitigable impacts from groundwater extraction to the affected basin within the NGLA; and significant but mitigable impacts to groundwater quality from the increased flow through the deteriorating GWA interceptor sewer system.

Nearshore Waters

Under Alternative E, proposed operations would be in compliance with the stormwater protection measures identified above that would ensure that there would be no increase in off-site transport of stormwater runoff, sediment, or other pollutants to nearshore waters for up to the 25-year design storm event. In addition, the vegetative cover between the Finegayan cantonment to the cliff edge and Haputo Bay and the AAFB family housing to the cliff edge under Alternative E (approximately 0.5 mile [0.8 km]) would provide a substantially greater additional buffer and protection from stormwater runoff or sediment reaching Haputo Bay than under Alternative A, which would have a buffer of only approximately 36 feet (11 m) between the construction area and the edge of the steep cliff. Therefore, there would be no direct and indirect long-term impacts to nearshore waters from stormwater runoff associated with increased impervious areas under Alternative E.

Water resources would be impacted by the increased wastewater discharge from the Northern District WWTP for treatment and disposal of generated wastewater for the operation of Finegayan cantonment and AAFB family housing. The associated potential impacts and mitigation would be similar to those described for construction-related impact. Refer to construction impacts above for a detailed discussion of WWTP discharge impacts and mitigation.

Wetlands

No wetlands are located in or near the proposed operational areas under Alternative E. Therefore, operations associated with Alternative E would result in no impacts to wetlands.

4.5.3 Air Quality

4.5.3.1 Affected Environment

Under Alternative E, the affected environment for Air Quality is as described for Alternative A (Section 4.1.3.1) and Alternative C (Section 4.3.3.1).

The area covered by Alternative E at Finegayan and AAFB is in attainment for all criteria pollutants. Air quality conditions at Finegayan and AAFB are affected predominantly by on-road mobile sources, on-base stationary sources, and aircraft operations.

4.5.3.2 Environmental Consequences

Construction

Direct emissions for criteria pollutants and CO_2 from short-term operation of on-site equipment and vehicles during construction (2016 through 2022) were estimated based on the acreage of disturbed earth and the number and type of facilities to be constructed. Given limited preparation activities anticipated in 2016, construction emissions are considered negligible and were not quantified for that year. The short-term direct emissions would be well below the potential impact significance criterion of 250 tpy for criteria pollutants, as shown in Table 4.5.3-1. The CO_2 emissions during construction period would be less than those analyzed in the 2010 Final EIS resulting in less GHG impacts as compared to the No-Action Alternative.

Table 4.5.3-1. Finegayan Cantonment/AAFB Family Housing Annual Construction Emissions (2016-2022)

Construction	*Pollutant (tpy)*						
Year	*SO_2*	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
2016	neg	neg	neg	neg	neg	neg	neg
2017	0.0	1.3	0.1	0.1	1.0	0.1	228.3
2018	0.3	18.6	1.1	1.0	14.4	1.9	3192.4
2019	0.6	34.6	2.1	1.9	26.8	3.6	5938.2
2020	0.2	11.0	0.7	0.6	8.5	1.1	1893.4
2021	0.7	41.3	2.5	2.2	32.0	4.3	7094.9
2022	0.3	19.0	1.2	1.0	14.7	2.0	3255.8

Legend: SO_2 = sulfur dioxide; CO = carbon monoxide; PM_{10} = particulate matter (<10 microns); $PM_{2.5}$= particulate matter (<2.5 microns); NO_x= nitrogen oxides; VOC= volatile organic compounds; CO_2 = carbon dioxide; neg = negligible.

Under Alternative E, the maximum emissions year on-site for annual PM levels predicted are slightly less than under Alternative A (Table 4.1.3-2) (i.e., 2.5 tpy as compared to 2.8 tpy for PM_{10} under Alternative A). Therefore, the short-term on-site hot-spot PM impacts around construction sites would be anticipated as less or similar to those under Alternative A that are shown in Table 4.1.3-3.

Off-Site On-Road Vehicle Hot-Spot Analysis for CO

The same hot-spot CO analysis procedures described for Alternative A were implemented in selecting the most congested and most affected intersections under this alternative for a hot spot impact analysis. Out of the 63 intersections, three worst-case intersections among those failing the screening were chosen for detailed analysis due to poor levels of service, high volumes, close proximity to sensitive receptors, and geographical representation. These three selected intersections are listed in Table 4.5.3-2.

CO concentration levels were predicted using CAL3QHC in association with the emissions factors predicted by MOVES. These predicted concentration levels were then added to the background levels to determine the total hot-spot concentration levels for construction and operation years. Table 4.5.3-2

shows the total concentrations for CO in comparison to the respective NAAQS. The predicted levels are well below the NAAQS, resulting in less than significant direct short-term CO impacts.

Table 4.5.3-2. Predicted Worst-Case CO Concentrations (ppm)

Site #	Site Description	Construction		Operation	
		1-hour	8-hour	1-hour	8-hour
1	Route 3/9/Chalan Santa Anita	2.3	2.2	2.4	2.3
2	Route 1 / Route 3	3.6	3.1	3.4	3.0
3	Route 16 / Route 27	2.9	2.7	3.0	2.7

Notes: 1-hour NAAQS = 35 ppm and 8-hour NAAQS = 9 ppm.
Source: GDPW 2013.

Off-Site On-Road Vehicle Hot-Spot Analysis for PM

As explained in Section 3.3.3, Alternative A is anticipated to have the greatest truck emissions impacts along the truck routes. Off-site on-road vehicle PM hot-spot impact concentrations for Alternative E would be similar in magnitude to those predicted for Alternative A (Section 4.1.3.2) at the analyzed intersections according to similar traffic patterns. Table 4.1.3-3 shows concentrations for PM (PM_{10} and $PM_{2.5}$) during the construction period in comparison to their respective NAAQS. The predicted levels of PM are well below the NAAQS resulting in less than significant hot-spot PM impacts during the construction period.

Off-Site On-Road Vehicle Hot-Spot Analysis for MSATs

MSATs concentration levels were predicted using CAL3QHC in association with the emissions factors predicted by MOVES. The screening-level MSAT dispersion modeling analysis was conducted at sensitive (actual) and sidewalk receptors for 2021 and 2030, which represent the peak construction year and the design year, respectively. The analysis was conducted for both a 30-year exposure and a longer, more conservative exposure duration of 70 years for cancer risks.

Maximum estimated increases in cancer risk at any of the receptors due to the project, as shown in Table 4.5.3-3, are all less than the threshold criterion of 10 in a million. Therefore, the direct, short-term impacts of all carcinogenic MSATs are considered acceptable and would be less than significant.

Table 4.5.3-3. Estimated Project Related Impacts Compared to Target Cancer Risk Threshold

	30-Year Estimated Cancer Risk Increase ($x10^{-6}$)		70-Year Estimated Cancer Risk Increase ($x10^{-6}$)		Target Cancer Risk Threshold
	Construction	Operation	Construction	Operation	
Sensitive Receptors					
Route 3/9/Chalan Santa Anita	0.155	0.142	0.362	0.332	10^{1}
Route 1 / Route 3	0.033	0.013	0.077	0.029	
Route 16 / Route 27	0.040	0.003	0.094	0.007	
Sidewalk Receptors					
Route 3/9/Chalan Santa Anita	0.076	0.073	0.178	0.170	10^{1}
Route 1 / Route 3	0.046	0.029	0.107	0.069	
Route 16 / Route 27	0.033	0.009	0.077	0.020	

Note: [1]Target threshold is 10 excess cancer cases in a million.
Source: GDPW 2013.

The maximum chronic hazard index at any of the receptors due to project emissions are well below the target limit of 1, as shown in Table 4.5.3-4. Therefore, the direct, short-term impacts of all non-carcinogenic MSATs are considered acceptable and would be less than significant.

Table 4.5.3-4. Estimated Project Related Impacts Compared to Target Hazard Index

Analysis Receptor	*30-Year Estimated Non-Cancer Chronic Hazard Index - Sensitive Receptors*		*30-Year Estimated Non-Cancer Chronic Hazard Index - Sidewalk Receptors*		*Target Hazard Index*
	Construction	*Operation*	*Construction*	*Operation*	
Route 3/9/Chalan Santa Anita	0.038	0.022	0.019	0.011	1[1]
Route 1 / Route 3	0.014	0.003	0.027	0.008	
Route 16 / Route 27	0.036	0.007	0.031	0.007	

Note: [1]Target hazard index indicates that exposure is below concentrations associated with adverse effects.
Source: GDPW 2013.

Operation

The traffic congestion conditions under Alternative E would be comparable to those discussed in Alternatives A and C. Under the Alternative E, the hot-spot impact analyses of off-site on-road vehicle CO and MSATs emissions during operational years were conducted and the analysis results are summarized in Table 4.5.3-2 for CO, and Tables 4.5.3-3 and 4.5.3-4 for carcinogenic and non-carcinogenic MSATs, respectively. Given the low levels of CO and MSATs impact concentrations predicted at hot spots under Alternative E, air quality impacts during long-term operational years are considered less than significant.

4.5.4 Noise

4.5.4.1 Affected Environment

The quantified noise impacts around AAFB from the 2013 AAFB AICUZ Study are used as the baseline noise levels for Alternative E. Figure 4.1.4-1 (see Section 4.1.4) shows the noise contours for the 65, 70, 75, 80, and 85 dB DNL contours and Table 4.1.4-1 (see Section 4.1.4) lists the corresponding amount of affected acreage.

In the vicinity of AAFB, noise contours extend off-base to the south and west, and there are populated areas currently within the noise contours up to 70 dB DNL as described in the 2013 AAFB AICUZ Study (Pacific Air Force 2013). Along the AAFB boundary, noise levels range from approximately 65 to 75 dB DNL in line with the end of the runway and dropping back down to below 65 dB DNL near both on- and off-base housing east of the Route 15 family housing gate.

4.5.4.2 Environmental Consequences

Construction

Under this alternative, noise would be generated from construction of various facilities, roadways, and infrastructure for development of the cantonment area, as well as noise from construction of off-site utilities development and DoD school expansions at AAFB. Marine Corps family housing under this alternative would be located at the area currently occupied by existing Air Force family housing.

Noise generated by construction activities for the main cantonment portion of this alternative would be similar to construction noise for Alternative A. For noise modeling purposes, it is assumed that 10 pieces of heavy equipment including multiple graders, excavators, dump trucks, and pavers would be used simultaneously at points nearest to the closest receptors for construction of the cantonment area.

Receptors that might be affected by Alternative E construction noise would comprise approximately 20 houses along Route 3 across the road from the proposed cantonment location. According to the Guam Bureau of Statistics, the average household size in the area is 3.67 people per household (GBSP 2010), thus it is estimated that about 70-75 people in these 20 houses that could be affected by implementation of Alternative E. Short- and long-term construction noise from development of the cantonment area would be the same as described for Alternative A in Section 2.4.4.1. The closest proposed construction activity for this alternative would occur approximately 500 feet (152 m) from the average receptor, with Route 3 frontage and noise levels estimated to be 65.4 dBA L_{eq}. Short-term increases in truck traffic used to transport materials on- and off-site would also produce noise disturbance of approximately 65 to 70 dBA L_{eq} within and near the construction corridors. Minimal to negligible direct impacts from construction noise are expected to result. In addition, direct short-term noise impacts would be less than significant because none of the houses along Route 3 would be close enough to experience noise exposure exceeding 75 dBA per USEPA guidelines (USEPA 1974). Long-term construction noise impacts would result from noise generated throughout the entire duration of construction. Construction activities would need to be within 525 feet (160 m) of the receptor to generate noise levels above the 65 dBA FICUN threshold. The impacted area at this distance comprises a very small percentage (<1%) of the total construction area, and would be considered short-term noise exposure because it would not remain at a consistent level for the entire 10-year period. Therefore, from this perspective, direct, long-term noise impacts from construction within the 525 feet zone (160 m) would be less than significant. Long-term construction noise impacts can also be addressed by modeling noise levels at the center of the cantonment area. The distance to the edge of the boundary is 2,500 feet (762 m), and if the amount of noise-generating construction equipment doubled in number, noise levels would be 54.5 dBA. This level is well below the FICUN level and meets the USEPA goal for an outdoor noise level of 55 dBA. Long-term direct and indirect noise impacts would be less than significant.

Housing construction noise would be similar to Alternative C and the existing (as well as proposed) housing abuts the property line and civilian housing south of the boundary abuts the property line from the south side. As a result, the proposed construction would be within 150 feet (46 m) of residences adjacent to AAFB housing. For this alternative, a construction scenario involving five pieces of heavy equipment operating at 150 feet (46 m) and five operating at 200 feet (61 m) is used since ten pieces of heavy equipment physically cannot operate at the same location 500 feet (46 m) at the same time relative to a receptor. Under this scenario, noise levels would be at 74.8 dBA L_{eq}, above the USEPA threshold guideline of 70 dBA L_{eq}. The 70 dBA L_{eq} threshold is used in this case because the construction would occur in areas with an ambient noise level greater than 60 dBA DNL. Although this represents the maximum potential adverse effect, it would be physically difficult to operate this many pieces of heavy equipment in such tight proximity to each other. As described for the other alternatives, the construction schedule for Alternative E implementation would be spread out. Approximately 20 homes housing about 75 people would be affected by noise from the family housing construction. Under this alternative, the following two different locations are analyzed: from a residential perspective and from the center of the family housing area. From the perspective of an individual receptor along the southern boundary of AAFB, noise levels above 65 dB would be considered incompatible for long-term land use noise exposure. The center of the family housing would be approximately 1,700 feet (518 m) from the southern boundary of AAFB and long-term noise levels would be about 58 dBA and well less than the FICUN criteria. Consequently, short-term and long-term construction noise impacts would be less than significant for Alternative E.

Construction activities common to all alternatives include off-site utilities and school expansions. Impacts due to these common construction projects would be as described in Section 4.1.4.2.

Consequently, potential direct and indirect short-term noise impacts under Alternative E for construction activities at Finegayan and construction activities for facilities common to all alternatives would be less than significant because increased noise levels would be short-term and would be below USEPA guidelines of 75 dBA $L_{eq.}$

Operation

Similar to Alternatives A and C, long-term noise impacts due to operation of the cantonment and family housing areas at AAFB would be considered less than significant.

After all construction has been completed, the long-term noise generating activities at Finegayan would be primarily due to traffic and aircraft noise. Traffic noise along Route 3 would increase but would be less than the levels described in the 2010 Final EIS (Volume 6, Chapter 8: Noise, Section 8.2.6: Off-Base Roadways, pages 8-14 to 8-15 and Volume 9, Appendix G: Chapter 6: Noise, Guam Community Build-up Figures, pages 1 to 10). Traffic noise under this alternative was estimated by comparing the increase of traffic relative to baseline for the 2010 Final EIS qualitatively and the increase of traffic due to this alternative. Using these comparisons and knowing the modeled noise levels from the 2010 Final EIS, the long-term, operational noise levels for implementation of Alternative E can be inferred. The highest noise levels along Route 3 determined in the 2010 Final EIS were 66 dBA at the nearest residences on Route 3 south of Route 28 to the intersection of Route 1. Traffic levels along that stretch of Route 3 and portions of Route 1 would be LOS "F," and compared to traffic along the same area under this alternative, the LOS would also be "F," indicating the road is beyond full capacity. Although the overall population increase would be less than predicted under the 2010 Final EIS, traffic noise would not appreciably change from the 2010 Final EIS because the road would be at full capacity (FHWA 2013). There would be no appreciable change in noise levels because an LOS of "F" is stop-and-go traffic indicative of heavy traffic. The noise levels would not change, just the duration of the levels. There would be less of an increase of population; therefore, the time of stop-and-go traffic would be less than the full buildup described in the 2010 Final EIS. However, GDPW transportation noise standards of 67 dBA would not be exceeded. There would be no new flying or range operations (and associated noise generation) at Finegayan, and long-term operation of Alternative E would not include industrial-type activities. Noise would be similar to an office park setting.

Aircraft noise generated by aircraft operating at AAFB would continue to affect family housing on AAFB. The proposed housing areas on AAFB would be located just outside the 65 dBA DNL noise zones with approximately the same amount of area in each zone. Details regarding compatibility are provided in Section 4.3.6, Land and Submerged Land Use of this SEIS.

Noise mitigation improvement such as sound walls would be constructed under the 2010 Final EIS reducing noise impacts in areas that are reasonable and technically feasible. Consequently, direct, long-term noise impacts under Alternative C would be less than significant.

Consequently, direct and indirect long-term noise impacts at Finegayan would be less than significant.

4.5.5 Airspace

4.5.5.1 Affected Environment

Airspace that would be impacted by the proposed action would be the same as described in the 2010 Final EIS. As indicated in Section 3.1.5 of this SEIS, designated airspace is associated with Guam International Airport and AAFB. Characteristics of the airspace have not changed since the 2010 Final EIS. Operations and functions associated with the cantonment/family housing facilities would consist of support, maintenance/storage, housing, and non-live fire training functions (see Section 2.2.1). No construction or operation activities would require changes to airspace. Therefore, the affected environment for airspace is only discussed in the context of the LFTRC components of the proposed action as provided in Chapter 5 of this SEIS.

4.5.5.2 Environmental Consequences

As discussed above, there would be no construction or operation activities requiring changes to airspace. Therefore, there would be no direct or indirect short- or long-term impacts on airspace from this component of the proposed action.

4.5.6 Land and Submerged Land Use

4.5.6.1 Affected Environment

The affected environment for land use associated with Alternative E is as described for Alternatives A (Section 4.1.6.1) and C (Section 4.3.6.3). In summary, the land and submerged lands associated with Finegayan cantonment, including Potts Junction, and AAFB family housing are federally owned. Finegayan is used primarily for communications functions, but there are community support and existing rifle and pistol small arms ranges. The SDZ for the ranges does extend into submerged lands and public access is restricted during training events for safety reasons. The AAFB has a full complement of land uses associated with an operational airbase and the family housing area is located on the southeastern boundary of the base. The Air Force operational facilities are focused around the airfield that is centrally located within the Main Base. Air Force housing and community support are located in the southeast portion of the Main Base. There are land use constraints that affect the Main Base, ESQD arcs associated with the MSA, the APZs and noise contours associated with the Main Base airfield, and the training range SDZs, as shown on Figure 4.5.6-1.

Adjacent land uses to the Finegayan parcel are private land (planned land use park/open space) and AAFB to the north, Route 3 and residential to the east, vacant open space (planned land use Hotel and Resort) to the south and the Philippine Sea to the west. The planned land uses are as described for Alternative A and shown on Figure 4.5.6-1.

The adjacent land use to the AAFB family housing area is residential and planned for residential.

4.5.6.2 Environmental Consequences

Land use impacts are addressed in this section. Land ownership impacts are addressed in Section 4.5.15, Socioeconomics and General Services.

Construction

As previously discussed in Section 3.6.3.1, Methodology, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource under any of the alternatives assessed in this SEIS.

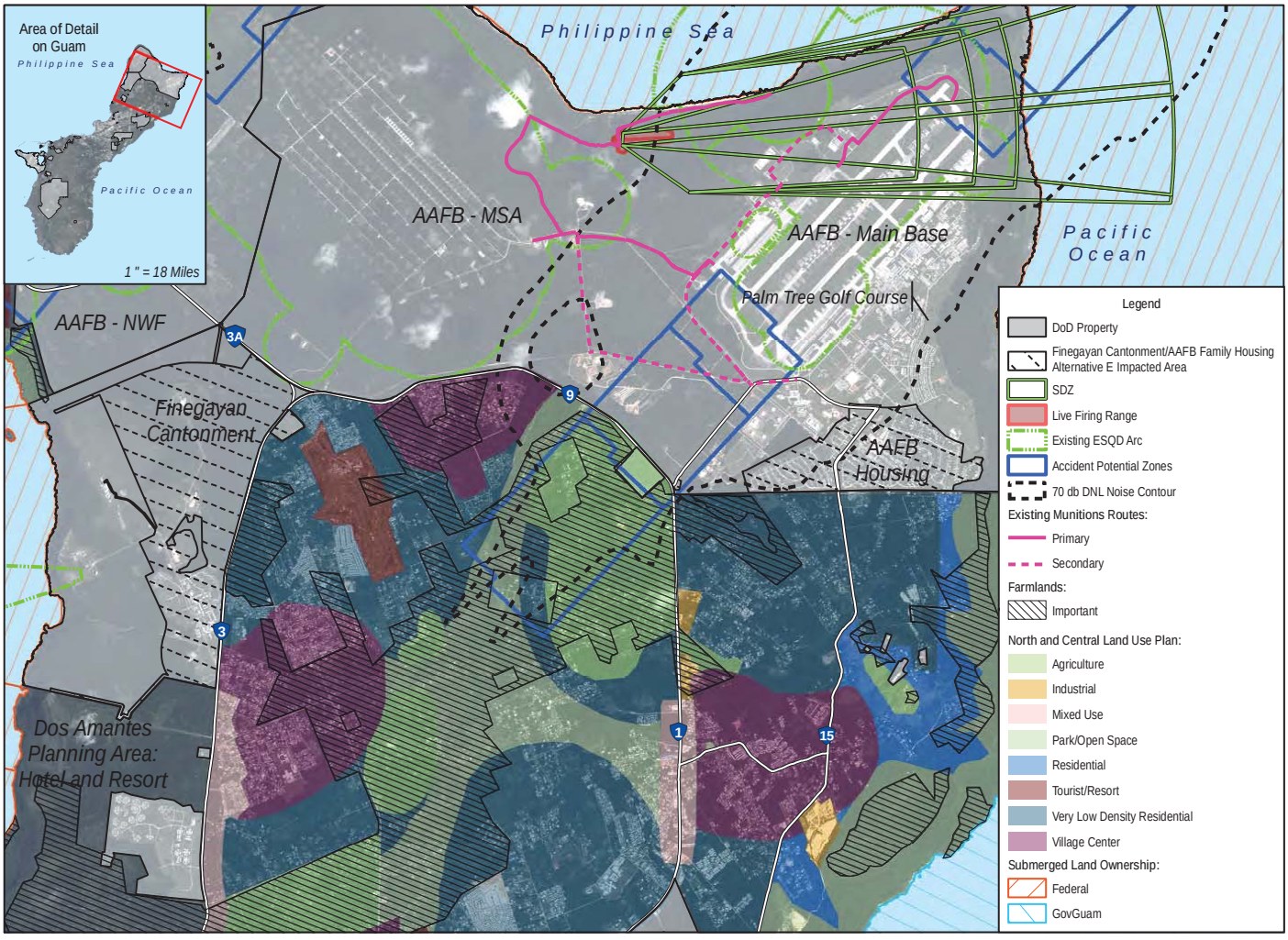


Figure 4.5.6-1
Land Use in the Vicinity of Finegayan Cantonment/AAFB Housing Alternative E

Sources: DON 2010, NAVFAC Pacific 2013

Operation

Alternative E would be generally restricted to Finegayan and AAFB (see Figure 4.5.6-1); however, there are off-base improvements (utilities and education facilities), some of which are specific to this alternative and some of which are common to all cantonment/family housing alternatives. Similar to Alternative A, Alternative E would require expansion of DoDEA High School and the Andersen Middle School. The schools are located on federal land and would be compatible with adjacent community support facilities on the installation and residential land uses in the surrounding communities. There would be no land use impacts on the surrounding communities.

All cantonment alternatives require water well development on AAFB. The affected environment and environmental consequences are described in Section 4.3.6 of this SEIS. The off-base utility improvements specific to this alternative (see Figure 2.4-13 in Chapter 2 of this SEIS) would be placed underground along existing roadways or within existing utility easements along Routes 3, 3A and 9. The off-base utility improvements common to all cantonment/family housing alternatives utility improvements would also be aligned along existing roadways (Routes 1, 3, and 9) (see Figure 2.4-14 in Chapter 2 of this SEIS). There would be no impact on land use resulting from the off-base utility improvements. However, additional inter-base IT/COMM connectivity would be required as described in Chapter 2. This includes the connection between AAFB and the existing Tata Cable landing facility in southern Guam, which would require new rights-of-way along some southern roads and the access road to the Tata facility.

The land use impacts associated with the Alternative E Finegayan cantonment are as described for the cantonment of Alternative A (Section 4.1.6.2). In summary, there would be no impact to the existing communications mission at Finegayan. Open space is incorporated in the design, but there would be less open space than currently exists at the parcel, resulting in less than significant direct impacts on land use in the adjacent civilian community. The proposed land uses on the Finegayan and Potts Junction parcels would be compatible with existing and planned Residential and Village Center adjacent land uses (Figure 4.5.6-1).

The land use impacts associated with the AAFB family housing are as described for Alternative C family housing (Section 4.3.6.2). The AAFB family housing would require redevelopment and expansion of existing military housing in the southeastern portion of Main Base adjacent to the installation boundary. There would be a long-term increase in development density in the housing area. The maximum height of the cantonment buildings would be six stories and the housing would be a maximum of two stories. Open space is incorporated in the design, but there would be less open space than currently exists at the parcel resulting in less than significant direct impacts on land use in the adjacent civilian community. The proposed family housing and community support facilities are consistent with existing land use planning for AAFB. However, as stated in the Noise Section, 4.3.4.2, aircraft noise generated by aircraft operating at AAFB would continue to affect family housing on AAFB.

The DoD Guidance discourages housing in areas above 65 dBA DNL and strongly discourages development in 70 dBA or greater. When these constraints are unavoidable, houses may be allowed with the incorporation of noise level reduction design features. Noise level reduction of 25 dBA would be required for 65-69 dBA DNL and 30 dBA for 70-74 dBA DNL, no noise level reduction is required for 60-64 dBA DNL (DoD 2011). Figure 4.5.6-1 shows the 70 dBA DNL noise contour generated by the AAFB airfield encumbering a portion of the family housing units. The long-term impact of the existing noise levels at AAFB on the proposed housing would be less than significant.

The proposed family housing at AAFB would be consistent and compatible with adjacent off-base existing and planned residential land use to the south. There would be no new access restrictions imposed on the public under this alternative and no impact on access was identified. Additionally, no submerged lands would be affected by implementation of Alternative E.

Alternative E would have similar impacts as Alternative A and C and less of an impact on land use resources compared to Alternative B.

4.5.7 Recreational Resources

4.5.7.1 Affected Environment

Use of the recreational resources located at Finegayan and AAFB are subject to the same access requirements as other on-base facilities; therefore, only installation personnel and guests are able to use the land-based recreational resources at Finegayan. Offshore and recreational uses in the area but outside the installation boundary are open to the public. One exception is the archery hunting area established within AAFB and north of Finegayan that is accessible to the public.

As described for Alternative A in Section 4.1.7.1, the recreational resources at Finegayan are located primarily along the coastal area of the property and centered on the Haputo ERA. Table 4.1.7-1 identifies the recreational resources near Finegayan. In summary, the recreational activities include hiking trails, fishing, swimming, snorkeling, and scuba diving.

As described for Alternative C in Section 4.3.7.1, the housing area would be constructed and/or replaced contiguous to Palm Tree Golf Course on the southeastern edge of the base. This golf course is not open to the public. AAFB existing recreational facilities include outdoor playing fields, a fitness center, a recreational center, an auditorium/theatre, and a youth center. Table 4.3.7.1 identifies other recreational activities within AAFB land or submerged land including, hiking, beaches, picnic areas, camping sites, parks, fishing, and scuba diving sites.

4.5.7.2 Environmental Consequences

Construction

The construction impacts would be as described for Alternatives A (Section 4.2.7.2) and C (Section 4.3.7.2). The short-term increase of construction-related vehicles on roads may cause delays to persons accessing recreational areas in both the Finegayan and AAFB areas. Staged construction equipment would not obstruct access to, or the use of, the recreational resources, but would inconvenience resource seekers (i.e., potential detours, longer waits, and other similar nuisances).

Similar to the other alternatives, a surge in construction-related population may lead to a reduction of recreational opportunities at existing facilities as more users would compete for recreational use (e.g., competing for picnic shelters). This competition for resources would likely be worse during weekends, holidays, and the months of July through March, which experience heavier tourist traffic. The general wear and tear of the available amenities would likely be accelerated due to the presence of additional users. However, the construction of Alternative E would not substantially reduce recreational opportunities, cause substantial conflicts between recreational users, or cause substantial deterioration of recreational resources. The road to Haputo and Double Reef trailheads would remain open during construction of the Finegayan cantonment. Therefore, Alternative E would result in short-term, less than significant direct impacts to recreational resources.

Operation

The operational impacts on recreational resources would be similar to those described under Alternative A (Section 4.1.7.2) and C (Section 4.3.7.2) because the same increases in on-island military population and pressure of recreational resources are proposed for all alternatives. The long-term addition of potential users could result in further congestion of recreation resources at AAFB and other sites on Guam.

The recreational resources at AAFB, including swimming at Tarague Beach and Sirena Beach, may be near carrying capacity. The construction of recreational facilities at AAFB would ensure that the addition of approximately 5,000 Marines and approximately 1,300 dependents to AAFB would not accelerate the deterioration of the existing recreational resources at AAFB and other sites on Guam. Therefore, direct and indirect long-term impacts to recreational resources would be less than significant.

The recreational resource impacts would be similar to Alternative A and C. Since Alternative E does not have significant impacts to recreational resources, the magnitude of recreational impacts would be less than Alternative D, which has potentially significant impacts. Relative to Alternative B that includes South Finegayan, the public would continue have access to the Latte Stone Park under Alternative E because the park is south of the Finegayan cantonment area.

4.5.8 Terrestrial Biological Resources

4.5.8.1 Affected Environment

The affected environment for the area associated with the proposed Finegayan cantonment component is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.2: Finegayan, pages 10-34 to 10-39), and is summarized in Section 4.1.8.1 of this SEIS. The affected environment for terrestrial biological resources associated with the proposed AAFB housing component is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: Andersen AFB, pages 10-16 to 10-31), and is summarized in Section 4.3.8.1 of this SEIS.

The description of the affected environment for each area is supplemented and updated with new information regarding biological surveys within the project areas conducted after the 2010 Final EIS. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for terrestrial biological resources, but it would reduce some potential impacts to terrestrial biological resources as described in the analysis of environmental consequences for Alternative E below. In addition, the biological resources affected environment described in this section includes areas associated with the development of infrastructure common to all alternatives (e.g., off-site utilities).

Vegetation Communities

Figures 4.5.8-1 and 4.5.8-2 show the vegetation communities within the Alternative E project footprints on Finegayan and AAFB. See Sections 4.1.8.1 and 4.3.8.1 for a description of the vegetation communities for Finegayan and AAFB, respectively. Utility corridors associated with Alternative E follow roadways, are in high-use areas on developed land, or are in areas with small amounts of herbaceous-scrub vegetation (Figure 4.5.8-2).

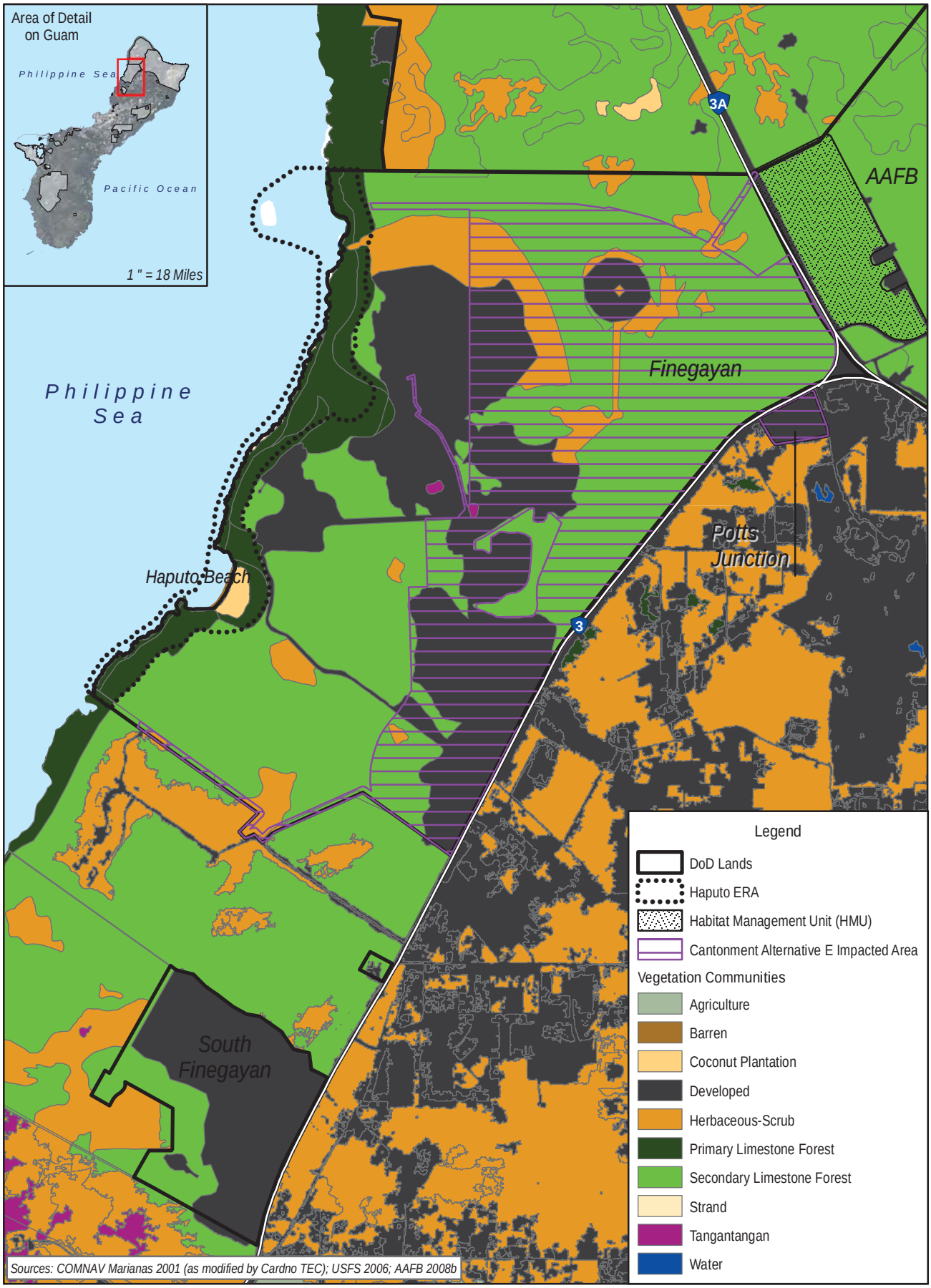


Figure 4.5.8-1
Vegetation Communities - Finegayan Cantonment Alternative E

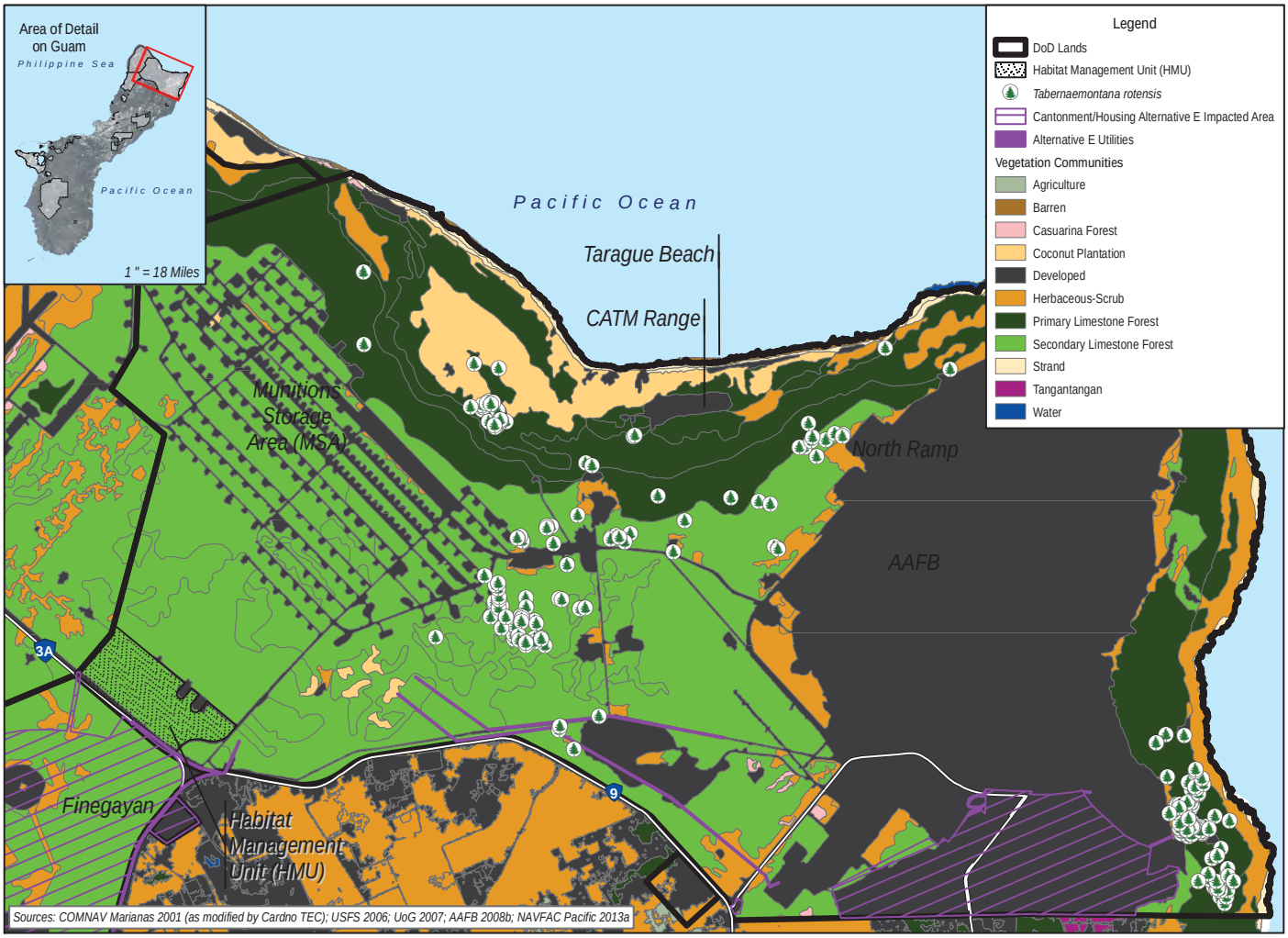


Figure 4.5.8-2
Vegetation Communities and Plant SOGCN Observations -
Finegayan and AAFB Cantonment/Housing Alternative E

Terrestrial Conservation Areas

Overlay Refuge. Currently, 21,690 acres (8,778 ha) is Overlay Refuge on lands administered by the DoD on Guam. The Overlay Refuge encompasses lands identified in the initial recovery plans as essential habitat for the recovery of the Mariana fruit bat, Guam Micronesian kingfisher, Mariana crow, and Guam rail. However, only the Mariana fruit bat still occurs in the wild on Guam. Additional information on Overlay Refuge lands is provided in Section 3.8.1.2 of this SEIS and the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.1.3: Special-Status Species, pages 10-8 to 10-9). All of the undeveloped area of Finegayan is within the established Overlay Refuge (Figure 4.5.8-3).

The proposed Alternative E housing area on AAFB does not contain any terrestrial conservation areas (Figure 4.5.8-3).

Wildlife - Native Species

See Sections 4.1.8.1 and 4.3.8.1 for a discussion of wildlife for Finegayan and AAFB, respectively.

Special-Status Species: Federal ESA-Listed and Proposed Species

One federal ESA-listed species (Mariana fruit bat), two proposed endangered species (*Dendrobium guamense* and *Tuberolabium guamense*), and one proposed threatened species (*Tabernaemontana rotensis*) may occur within Finegayan and the proposed Alternative E utility corridor at AAFB (Figures 4.5.8-4 and 4.5.8-5; Table 4.5.8-1). Although "suitable habitat" for special-status species is present within the Alternative E project areas, the brown treesnake, the primary factor in the extirpation of special-status wildlife species on Guam and one of the largest obstacles to achieving recovery of special-status species, is still considered abundant and widespread on Guam. Until brown treesnakes are suppressed or removed from at least targeted areas on Guam, the habitat is not in a suitable condition to support the survival of special-status species due to current snake abundance on Guam (e.g., Guam Micronesian kingfisher, Guam rail, Mariana crow) (USFWS 2010a). A brief summary of each species is provided in Sections 4.1.8.1 (Finegayan) and 4.3.8.1 (AAFB), including new information about each species within the project area since the completion of the 2010 Final EIS. Further detail is provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: Andersen AFB, pages 10-34 to 10-31).

Special-Status Species: Guam-Listed and SOGCN

Three Guam-listed endangered species (Micronesian starling, moth skink, and Pacific slender-toed gecko) occur within the Alternative E project areas on Finegayan and AAFB (see Figures 4.5.8-2, 4.5.8-4, and 4.5.8-5; Table 4.5.8-1). A brief summary of each species is provided in Sections 4.1.8.1 (Finegayan) and 4.3.8.1 (AAFB), including new information about each species within the project area since the completion of the 2010 Final EIS. Further detail is provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: AAFB, pages 10-34 to 10-31).

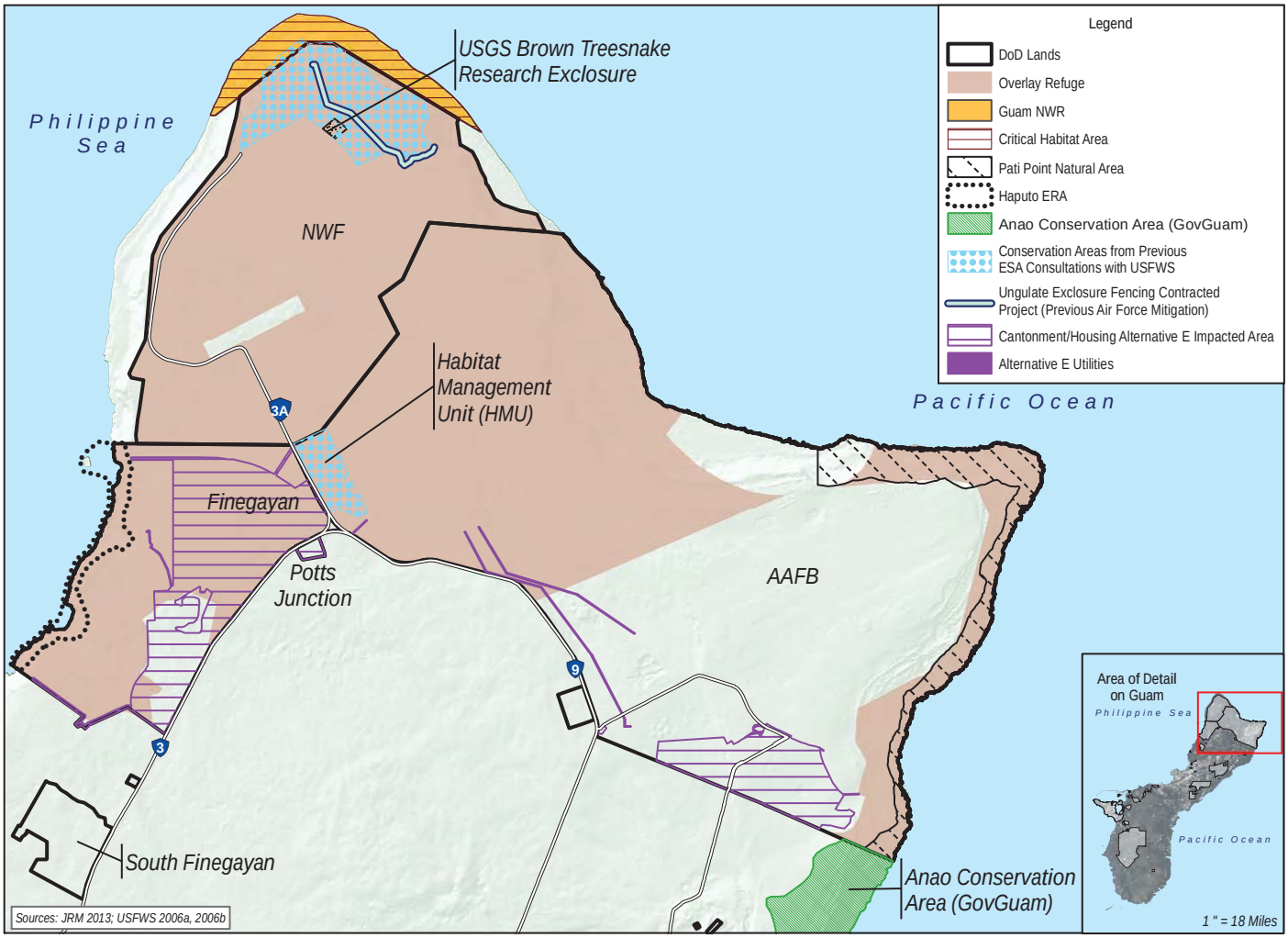
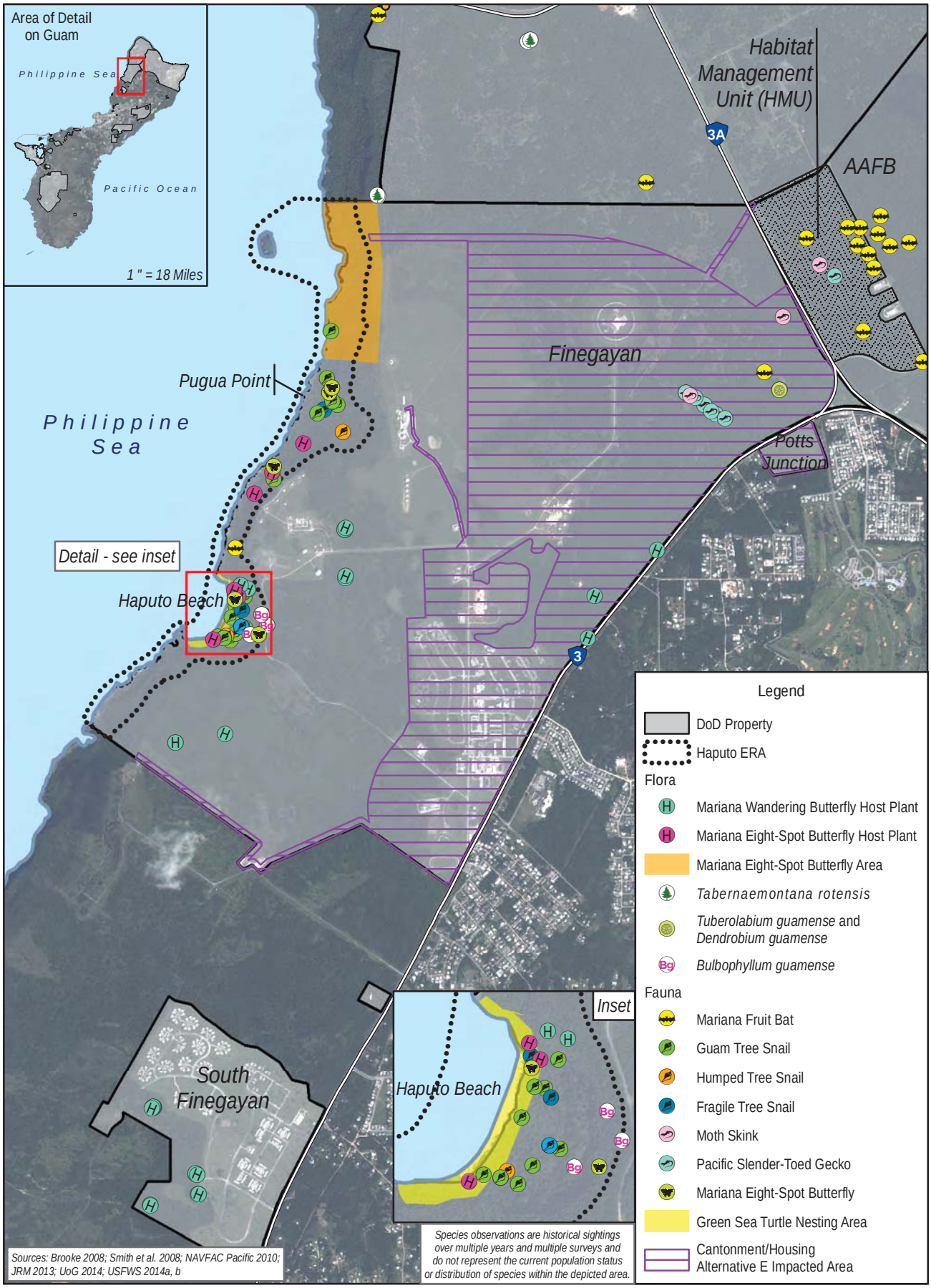


Figure 4.5.8-3
Terrestrial Conservation Areas - Finegayan and AAFB
Cantonment/Housing Alternative E



0 1,000 2,000 Feet

0 200 400 Meters

Figure 4.5.8-4
Special-Status Species Observations - Finegayan
Cantonment Alternative E

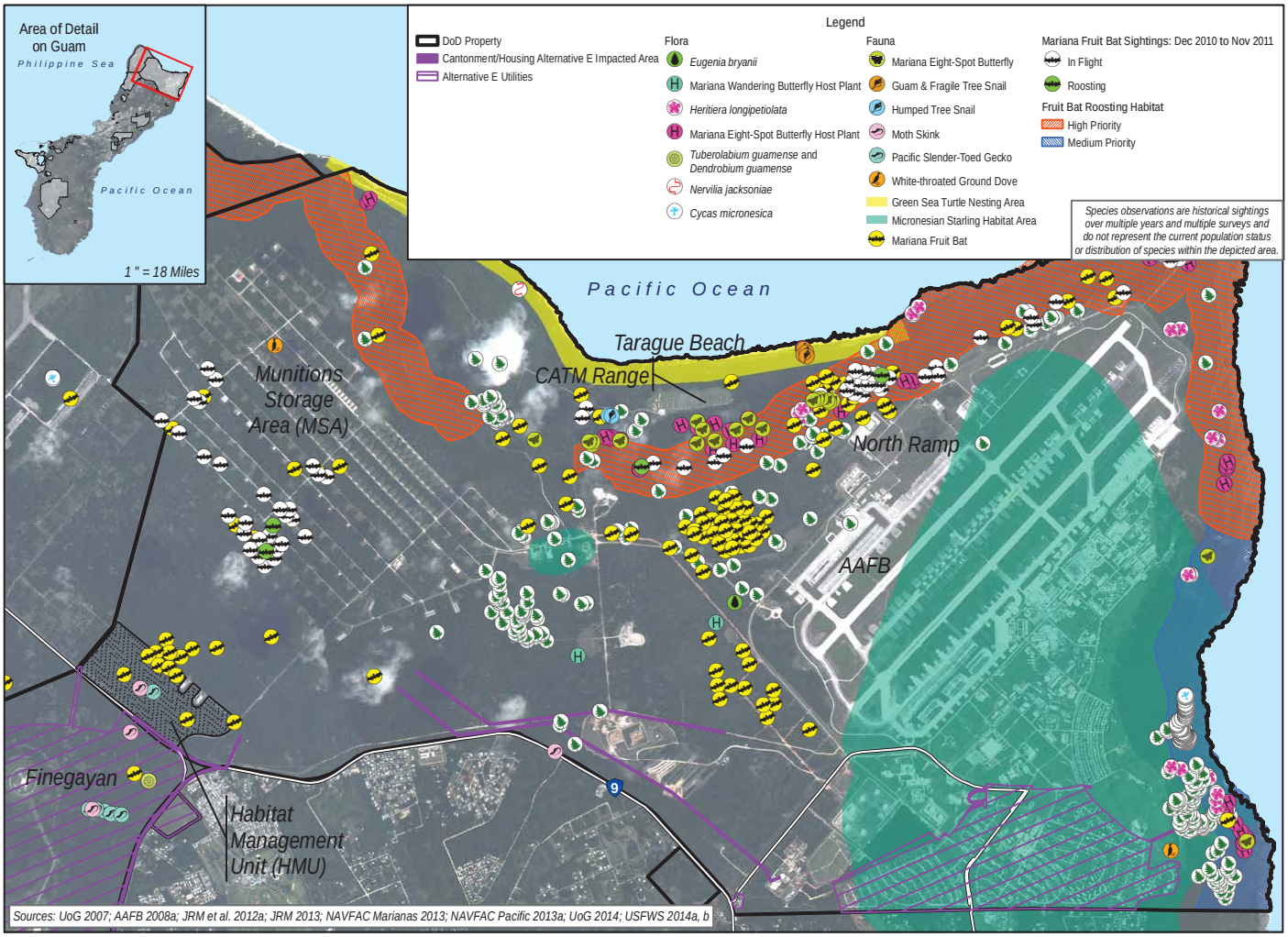


Figure 4.5.8-5
Special-Status Species Observations - Finegayan and AAFB
Cantonment/Housing Alternative E

Table 4.5.8-1. Distribution of Special-Status Species at Finegayan and AAFB under Alternative E

Name	*Status**		*Habitat*	*Known to Occur†*	*Comments†*
	ESA[d]	*Guam[j]*			
Mammals					
Mariana fruit bat[a, c, m, t, u, v, bb]	T	E	Limestone forest, coastal forest, and coconut plantations.	Fin: Yes	Although observed within the adjacent HMU, last observations at Finegayan were in 2008; no known colonial roost sites; recovery habitat present.
				AAFB: Yes	Few individuals occur throughout AAFB; no known colonial roost sites; recovery habitat present.
Birds					
Mariana swiftlet[a, m]	E	E	Limestone cliffs with caves for roosting & nesting; forages over forest and grasslands.	Fin: No	NR
				AAFB: No	NR; one nest/roost cave at Ritidian Point that was abandoned in late 1970s.
Mariana crow[w, bb]	E	E	All forests with a preference for native limestone forest.	Fin: No	Extirpated from Guam - last seen on Finegayan in the 1990s and on AAFB in 2012; recovery habitat present on Finegayan and AAFB.
				AAFB: No	
Guam rail[y, bb]	E	E	Secondary habitats, some use of savanna and limestone forests.	Fin: No AAFB: No	Extirpated from the wild on Guam by 1985; recovery habitat present on Finegayan and AAFB.
Guam Micronesian kingfisher[x, bb]	E	E	Forest and scrub with a preference for native limestone forest.	Fin: No AAFB: No	Extirpated from the wild on Guam by 1988; recovery habitat present on Finegayan and AAFB.
Micronesian starling[a, m, aa]	-	E	All habitats but higher density in forests.	Fin: Yes	Infrequent observations near the main gate of Finegayan.
				AAFB: Yes	Present in the AAFB family housing area and occasionally throughout AAFB.
White-throated ground dove[m, n]	-	E	Prefers native limestone and ravine forests.	Fin: No	NR
				AAFB: N	Rare observations within MSA and southeastern corner of AAFB.
Reptiles					
Moth skink[j, k, l, m]	-	E	Forest areas with large tree trunks.	Fin: Y	Detected in 2008 and 2011 in northeastern corner; reported in the early 1990s at Haputo Beach area.
				AAFB: Yes	Reported in 2009 at one location in proposed utilities area.
Pacific slender-toed gecko[j, k, l, m]	-	E	Forest edge.	Fin: Yes	Observed in 2009 in northeastern area.
				AAFB: No	Observed in the HMU.
Invertebrates					
Mariana eight-spot butterfly[k, h, m, o, s]	PE	-	Intact limestone forest with host species.	Fin: No	Host plants, eggs and larvae in Haputo ERA.
				AAFB: No	Host plants, eggs and larvae in Tarague Basin.
Mariana wandering butterfly[o, z]	PE	-	Larvae feed on one known host plant species found in native limestone forest habitat.	Fin: No AAFB: No	Has not been seen on Guam since 1979 and considered extirpated; single remaining population occurs on Rota, CNMI; host plants observed within impacted areas of Finegayan and AAFB.
Guam tree snail[a, e, i, o]	PE	E	Cool shaded forested areas with high humidity.	Fin: No	Reported in 1989, 2007, and 2013 at Haputo ERA.
				AAFB: No	NR during 2013 surveys.

Table 4.5.8-1. Distribution of Special-Status Species at Finegayan and AAFB under Alternative E

Name	*Status**		*Habitat*	*Known to Occur†*	*Comments†*
	ESA[d]	*Guam[j]*			
Humped tree snail[a, f, i, m, o]	PE	E	Cool shaded forested areas with high humidity.	Fin: No	Reported in 1989, 2007, and 2013 at Haputo ERA.
				AAFB: No	NR during 2013 surveys.
Fragile tree snail[a, g, i, m, o]	PE	E	Cool shaded forested areas with high humidity.	Fin: No	Reported in 1989, 2007, and 2013 at Haputo ERA.
Plants					
Serianthes tree[a, c, m, r, s, bb]	E	E	Limestone and ravine forests.	Fin: No	NR during 2010 and 2012 surveys; recovery habitat present.
				AAFB: No	NR during 2010 and 2012 surveys; recovery habitat present; individual trees only occur at AAFB at NWF and Tarague Basin.
Heritiera tree[a, b, m, s]	PE	E	Limestone cliffs and plateaus.	Fin: No	NR during 2010 and 2012 surveys.
				AAFB: No	NR during 2010 and 2012 surveys.
Tabernaemontana rotensis[l, m, q, s]	PT	SOGCN	Limestone forest.	Fin: No	NR during 2010 and 2012 surveys.
				AAFB: Yes	Individuals observed within or in vicinity of proposed utility line corridors.
Cycas micronesica[k, l, m, s]	PE	SOGCN	Limestone forest, ravine forest, and savanna summits.	Fin: No	NR during 2010 and 2012 surveys.
Dendrobium guamense[cc]	PE	-	Lowland/limestone forests.	Fin: Yes AAFB: No	One occurrence within northeastern area of Finegayan.
Tuberolabium guamense[cc]	PE	-	Lowland/limestone forests.	Fin: Yes AAFB: No	One occurrence within northeastern area of Finegayan.

Legend: - = not listed, E = endangered, NR = not reported within impacted areas, PE = proposed endangered, PT = proposed threatened, T = threatened. †Occurrence within Finegayan (Fin) or AAFB cantonment/family housing or utility impacted areas.

Sources: [a]Wiles *et al.* 1995; [b]GDAWR 2006; [c]USFWS 2010a; [d] USFWS 2011; [e] USFWS 2012a; [f] USFWS 2012b; [g] USFWS 2012c; [h] USFWS 2012d; [i]Smith *et al.* 2008; [j]GovGuam 2009; [k]NAVFAC Pacific 2010, [l]NAVFAC Pacific 2010; [m]JRM 2013; [n]NAVFAC Marianas 2013b; [o]UoG 2014; [p]Grimm and Farley 2008; [q]UoG 2007; [r]USFWS 1994; [s]NAVFAC Pacific 2013a, 2013b; [t]AAFB 2008b; [u]JRM *et al.* 2012a; [v]JRM *et al.* 2012b; [w]USFWS 2005; [x]USFWS 2008; [y]USFWS 2009b, BirdLife International 2013; [z]USFWS 2012e; [aa]Personal communication from J. Farley, NAVFAC Marianas, to R. Spaulding, Cardno TEC, regarding Micronesian starling observations at NCTS Finegayan during December 2010 Christmas Bird Count, 26 February 2014; [bb]USFWS 2010b; [cc]USFWS 2014a, 2014b.

4.5.8.2 Environmental Consequences

Construction

Vegetation. The vegetation communities that would be impacted during proposed facility and infrastructure construction activities under Alternative E are shown within the outlined impact footprint in Figure 4.5.8-1 for the proposed Finegayan cantonment area and Figure 4.5.8-2 for the proposed AAFB housing and utility areas. Under Alternative E, approximately 2 acres (0.8 ha) of primary limestone forest and 778 acres (315 ha) of secondary limestone forest would be removed during proposed construction activities (Table 4.5.8-2). Approximately 132 acres (54 ha) of other plant communities, primarily herbaceous scrub, and 1,037 acres (420 ha) of developed areas would also be impacted.

Native limestone forest, both primary and secondary, has been significantly reduced on Guam due to past and ongoing actions including extensive disturbance during and after WWII, widespread planting of non-native species; and impacts from non-native ungulates; development; fire; and deforestation. As stated in Section 3.8.1.1, limestone forests provide important since they retain the functional ecological components of native forest that provide habitat for the majority of Guam's native species, including ESA-listed, ESA-proposed, and Guam-listed species and Guam SOGCN, as well as maintaining water

quality and reducing fire risk. Non-native forest communities (e.g., tangantangan, *Vitex*) significantly alter the forest structure, composition, and resilience to other disturbance processes and do not provide the conditions suitable for native flora and fauna species to persist (Morton *et al.* 2000; GDAWR 2006; Guam Department of Agriculture 2010; JRM 2013).

Table 4.5.8-2. Direct Construction-Related Impacts to Vegetation Communities with Implementation of Cantonment/Family Housing Alternative E (acres [ha])

Project Component	*Vegetation Community (acres [ha])*						
	PLF	***SLF***	***HS***	***TT***	***CP***	***Dev***	***Total***
Finegayan cantonment	0.4 (0.2)	687.6 (278.3)	114.0 (46.1)	1.0 (0.4)	0	418.3 (169.3)	**1,221.3 (494.3)**
AAFB family housing	<0.1 (<0.1)	12.6 (5.1)	0.3 (0.1)	0	0	488.8 (197.8)	**501.8 (203.1)**
Utility corridor specific to Alternative E	<0.1 (<0.1)	20.8 (8.4)	2.5 (1.0)	0	<0.1 (<0.1)	24.8 (10.0)	**48.1 (19.5)**
Utility corridors and water well areas common to Alternatives A-E	1.5 (0.6)	56.6 (22.9)	9.6 (3.9)	4.5 (1.8)	0	77.6 (31.4)	**149.8 (60.6)**
High School/Middle School Expansions	0	0	0	0.3 (0.1)	0	27.7 (11.2)	**28.0 (11.3)**
Total	**1.9 (0.8)**	**777.6 (314.7)**	**126.4 (51.2)**	**5.8 (2.3)**	**<0.1 (<0.1)**	**1,037.2 (419.7)**	**1,949.0 (788.7)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; TT = tangantangan; CP = coconut plantation; Dev = developed.

Of the 18,538 acres (7,502 ha) of primary and secondary limestone forest found on Guam, approximately 13,110 acres (5,305 ha) (or 71%) are found on federal lands, primarily within AAFB, Finegayan and the NAVMAG (USFS 2006). Under Alternative E, a total of approximately 2 acres (1 ha) of primary limestone forest and 778 acres (315 ha) of secondary limestone forest would be removed, primarily associated with the cantonment housing component (see Table 4.5.8-2). Therefore, given the importance of limestone forest habitat for native species and the continuing loss of native limestone forest across Guam, the conversion of 780 acres (316 ha) of limestone forest to developed area would be a significant but mitigable impact to the regional vegetation community and its function.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on vegetation communities with implementation of Alternative E. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the contractor education program.
- *Onsite Vegetation Waste Management Procedures.* See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the vegetation waste management procedures.
- *DON Guam Landscaping Guidelines*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of landscaping guidelines.

- *Contractor Plans and Specifications*. All construction would occur within the limits of construction shown in the project figures.

Potential Mitigation Measures

To mitigate for significant impacts to limestone forest, the DON proposes to implement forest enhancement on a minimum of 780 acres (316 ha) of limestone forest. Forest enhancement would include but is not limited to the following actions:

- Ungulate management consisting of exclusion fencing and active control (i.e. trapping, snaring, shooting) with the goal of eradication within the fenced areas.
- Non-native, invasive vegetation removal.
- Propagation, planting, and establishment of native species that are characteristic of native limestone forest habitats (e.g., *A. mariannensis, G. mariannae, F. prolixa, M. citrifolia, W. elliptica*).

The degradation and loss of primary limestone and other forest habitats resulting from ungulate damage and invasion by alien plant species has substantially diminished the extent of habitat for native species in the Mariana archipelago. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including special-status species. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Terrestrial Conservation Areas. All cantonment components would be constructed on the upper plateau area of Finegayan. Construction personnel are issued base passes for official business only within proposed construction areas; these restrictions are specified in construction contracts. Use of Haputo ERA is not expected to increase as a result of construction activities under Alternative E, therefore there would be no impact associated with construction personnel. In addition, locating the proposed housing component of the proposed action at AAFB and not at Finegayan as is proposed under Alternatives A and B, would further reduce potential impacts on the Haputo ERA. The Haputo ERA would not be directly impacted and would continue to serve as a migration corridor for species moving or dispersing from AAFB and Finegayan to suitable habitat further south or from these areas to the north.

The only terrestrial conservation area within the impacted areas of Alternative E is Overlay Refuge (see Figure 4.5.8-3). Overlay Refuge lands were established for the purpose of conserving and protecting ESA-listed species and other native flora and fauna, maintaining native ecosystems, and conserving native biological diversity, recognizing that the primary purpose of lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force.

Under Alternative E, approximately 1,065 acres (431 ha) of Overlay Refuge lands (Table 4.5.8-3), or 4.9% of the total Overlay Refuge lands on Guam, would be directly impacted. This area overlaps with the vegetation communities discussed above. The majority of the impacted Overlay Refuge lands are associated with the cantonment component within Finegayan and is comprised primarily of secondary limestone forest (Table 4.5.8-3 and Figure 4.5.8-3). Therefore, because proposed construction activities would convert 1,065 acres (431 ha) of Overlay Refuge lands to developed areas, this would be a significant loss to the conservation function of these lands and implementation of Alternative E would result in significant but mitigable impacts to terrestrial conservation areas.

Table 4.5.8-3. Direct Construction-Related Impacts to Overlay Refuge with Implementation of Cantonment/Family Housing Alternative E

Project Component	*Overlay Refuge (acres [ha])*						
	PLF	***SLF***	***HS***	***TT***	***CP***	***Dev***	***Total***
Finegayan cantonment	0.4 (0.2)	633.2 (256.2)	110.1 (44.6)	1.0 (0.4)	0	163.8 (66.3)	**908.5 (367.7)**
AAFB housing	0	0	0	0	0	0	**0**
Utility corridor specific to Alternative E	<0.1 (<0.1)	12.0 (4.9)	<0.1 (<0.1)	0	<0.1 (<0.1)	4.0 (1.6)	**16.2 (6.6)**
Utility corridors and water well areas common to Alternatives A-E	1.5 (0.6)	47.1 (19.1)	9.6 (<0.1)	4.5 (1.8)	0	77.4 (31.3)	**140.1 (56.7)**
Total Overlay Refuge Impacted	**1.9 (0.8)**	**692.3 (280.2)**	**119.7 (48.4)**	**5.5 (2.2)**	**<0.1 (<0.1)**	**245.2 (99.2)**	**1,064.6 (430.8)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; TT = tangantangan; CF = *Casuarina* forest; CP = coconut plantation; Dev = developed.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on terrestrial conservation areas with implementation of Alternative E. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

The same BMPs discussed previously under *Vegetation* would be implemented for terrestrial conservation areas.

Potential Mitigation Measures

To mitigate for significant impacts to terrestrial conservation areas, the DON would submit a proposal to CNO Energy and Environmental Readiness Division to designate an ERA on the NAVMAG to conserve native limestone forest in southern Guam which provides habitat for special-status species. The DON has defined an ERA as a physical area or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural, physical, and biological processes to prevail without human intervention. However, under unusual circumstances, deliberate manipulation (e.g., removal or control of invasive species) may be utilized to maintain the unique feature that the ERA was established to protect (NAVFAC 1996). The proposed NAVMAG ERA would encompass approximately 553 acres (234 ha). Although the proposed NAVMAG ERA is currently part of the Overlay Refuge, implementation of these potential mitigation measures would provide an increased level of protection by further ensuring this area is maintained in natural and near natural conditions and to have available such areas for research and scientific manipulation (NAVFAC 1996; NAVFAC Marianas 2010).

In addition, the DON proposes to submit a proposal to CNO Energy and Environmental Readiness Division to expand the existing Orote ERA by approximately 32 acres (13 ha) of terrestrial habitat. The Final Orote ERA Expansion proposal was completed FY 2013 and will be submitted for approval in 2014.

Wildlife - Native Species. No additional impacts to native wildlife species from construction of the cantonment area at Finegayan beyond those described for Alternative A would occur under Alternative E. Impacts to native wildlife species for construction of the family housing components at AAFB would be as described for Alternative C. Implementation of Alternative E would not have a significant adverse effect on a population of any migratory bird species or other native wildlife species. Non-listed native

reptiles are abundant throughout Guam and impacts to vegetation communities under Alternative E would result in less than significant impacts to non-listed native reptile populations. Therefore, as presented above, long-term, direct impacts to populations of native wildlife species would not result because these species are abundant in surrounding areas and could repopulate portions of suitable habitat within the affected area after construction. Therefore, direct impacts to native wildlife would be less than significant with implementation of proposed construction activities associated with Alternative E.

Proposed construction activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. To prevent the inadvertent spread of non-native species on Guam or to other locations off of Guam, the DON would implement standard biosecurity measures (e.g., HACCP, brown treesnake interdiction measures, coconut rhinoceros beetle vegetation management procedures, outreach/education, and monitoring to evaluate effectiveness of HACCP) into construction protocols, procedures, and activities.

The following BMPs would be implemented to avoid and minimize potential direct, long-term impacts of proposed construction activities on native wildlife with implementation of Alternative E.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

With implementation of these BMPs, including development of HACCP plans and ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species (e.g., coconut rhinoceros beetle), the potential for the introduction of new or spread of existing non-native species on Guam is substantially reduced. Therefore, there would be less than significant impacts to native wildlife species related to the potential introduction and establishment of non-native species with implementation of proposed construction activities associated with Alternative E.

Damage of forested areas, particularly primary and secondary limestone forests, by non-native ungulates (i.e., deer and pigs) is a serious concern on Guam. Under Alternative E, removal of large amounts of secondary limestone forest currently used by ungulates would displace and concentrate ungulates into adjacent areas, resulting in even higher densities and potentially greater habitat damage. Potential impacts from changes in ungulate densities from construction projects within the same or similar habitat areas as proposed in this SEIS were addressed in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-115).

The implementation of the potential mitigation measures under the *Vegetation* section above would also benefit native wildlife species. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. Approximately 719 acres (291 ha) of Mariana fruit bat recovery habitat would be removed due to proposed construction activities at Finegayan and AAFB under Alternative E (Table 4.5.8-4). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.5.8-4. Summary of Permanent Construction-Related Impacts to Mariana Fruit Bat Recovery Habitat with Implementation of Cantonment/Family Housing Alternative E

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment	650.4 (263.2)
AAFB housing	8.2 (3.3)
Utility corridor specific to Alternative E	12.6 (5.1)
Utility corridors and water well areas common to Alternatives A-E	47.3 (19.1)
Total Recovery Habitat Impacted	**718.5 (290.8)**

Additional potential direct temporary impacts to the Mariana fruit bat from construction activities are based on the distances from those activities that are likely to cause disturbance to this species (e.g., noise, human activity, lighting). The evaluation of fruit bat disturbance is based on the approach used by USFWS in previous ESA section 7 formal consultations and associated BOs (e.g., USFWS 2006b, 2010). These distances are: roosting habitat within 492 feet (150 m) and foraging habitat within 328 feet (100 m) from the activity (Wiles, personal communication 2006 and Janeke, personal communication 2006, respectively, as cited in USFWS 2006b).

The Mariana fruit bat is currently limited to the few areas on Guam away from human activities and with suitable habitat, primarily on federal lands on NAVMAG and AAFB (JRM *et al.* 2012a, 2012b; JRM 2013; A. Brooke, NAVFAC Marianas, personal communication). There are no historical fruit bat roost sites at Finegayan and there have been only two observations of fruit bats on or adjacent to Finegayan since the 1990s (Wiles *et al.* 1995; Brooke 2008). However, there is recovery habitat within the Alternative E impacted areas. Although it appears that fruit bats are frequently observed at AAFB north of the proposed Alternative E impacted area (see Figure 4.5.8-5), the clusters of fruit bat detections are an artifact of the number of station count surveys conducted in that particular location. No more than two fruit bats have been observed in flight during each detection during recent surveys at AAFB (JRM *et al.* 2012b, 2012c, 2012d).

Illegal hunting, loss and degradation of native forest, predation by the brown treesnake, and the increased extirpation risk owing to the high vulnerability of very small populations continue to limit the potential recovery of the species on Guam (USFWS 2010; JRM 2013). Based on the equilibrium/carrying capacity of snakes on Guam (Rodda and Savidge 2007), implementation of the proposed action is not expected to increase the likelihood of predation by the brown treesnake on Mariana fruit bats.

Although the loss of 719 acres (291 ha) of fruit bat recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, it would reduce the total number of bats that the island can support. Given this loss of recovery habitat and the critically low numbers of bats on Guam, there would be significant but mitigable impacts to the Mariana fruit bat.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on Mariana fruit bats with

implementation of Alternative E. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Pre-Construction Surveys*. Surveys would be completed within suitable fruit bat habitat 1 week prior to onset of construction activities following the USFWS-approved JRM protocol. If a fruit bat is present within 492 feet (150 m) of the project site, the work must be postponed until the bat has left the area.
- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all new roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

Potential Mitigation Measures

The same potential mitigation measures discussed previously under *Vegetation* (i.e., forest enhancement of 780 acres [316 ha] of limestone forest) would be applicable for the Mariana fruit bat and its recovery habitat. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana fruit bat. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

MARIANA CROW. The Mariana crow is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the crow is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the crow, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative E, impacts to the crow would be limited to recovery prospects. If crows are reintroduced and exposed to construction activities under Alternative E, they may be disturbed (DON 2014).

Although the crow no longer occurs on Guam, approximately 719 acres (291 ha) of crow recovery habitat would be removed due to proposed construction activities at Finegayan and AAFB under Alternative E (Table 4.5.8-5). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.5.8-5. Summary of Permanent Construction-Related Impacts to Mariana Crow Recovery Habitat with Implementation of Cantonment/Family Housing Alternative E

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment	650.4 (263.2)
AAFB housing	8.2 (3.3)
Utility corridor specific to Alternative E	12.6 (5.1)
Utility corridors and water well areas common to Alternatives A-E	47.3 (19.1)
Total Recovery Habitat Impacted	**718.5 (290.8)**

Although this loss of recovery habitat on Guam would not preclude the recovery of the crow should it be reintroduced to Guam in the future, it would reduce the total number of crows that the island can support. If and when the crow is reintroduced to Guam, the best available information indicates project-related noise would not further reduce the amount of recovery habitat suitable for this species' breeding, feeding and sheltering (USFWS 2010). Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Mariana crow.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of the Mariana crow with implementation of Alternative E. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under Vegetation (i.e., forest enhancement of 780 acres [316 ha] of limestone forest) would be applicable for the Mariana crow and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana crow, should it be reintroduced to Guam in the future.

GUAM RAIL. The Guam rail is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the rail is reasonably certain to occur and it is likely to be exposed to

the effects of the action. There are currently neither projected dates for re-introduction of the rail, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the rail is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative E, impacts to the rail would be limited to recovery prospects. If rails are reintroduced and exposed to construction activities under Alternative E, they may be disturbed (DON 2014).

Although the rail no longer occurs on Guam, approximately 507 acres (205 ha) of rail recovery habitat would be removed due to proposed construction activities at Finegayan and AAFB under Alternative E (Table 4.5.8-6). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.5.8-6. Summary of Permanent Construction-Related Impacts to Guam Rail Recovery Habitat with Implementation of Cantonment/Family Housing Alternative E

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment	408.8 (165.4)
AAFB housing	39.7 (16.1)
Utility corridor specific to Alternative E	17.1 (6.9)
Utility corridors and water well areas common to Alternatives A-E	41.5 (16.8)
Total Recovery Habitat Impacted	**507.1 (205.2)**

Although this loss of recovery habitat on Guam would not preclude the recovery of the rail should it be reintroduced to Guam in the future, it would reduce the total number of rails that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam rail.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the recovery of the Guam rail with implementation of Alternative E. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 780 acres [316 ha] of limestone forest) would be applicable for the Guam rail and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated

benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam rail, should it be reintroduced to Guam in the future.

GUAM MICRONESIAN KINGFISHER. The kingfisher is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the kingfisher is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the kingfisher, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the kingfisher is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative E, impacts to the kingfisher would be limited to recovery prospects. If kingfishers are reintroduced and exposed to construction activities under Alternative E, they may be disturbed (DON 2014).

Although the kingfisher no longer occurs on Guam, approximately 719 acres (291 ha) of kingfisher recovery habitat would be removed due to proposed construction activities at Finegayan and AAFB under Alternative E (Table 4.5.8-7). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.5.8-7. Summary of Permanent Construction-Related Impacts to Guam Micronesian Kingfisher Recovery Habitat with Implementation of Cantonment/Family Housing Alternative E

Project Component	***Recovery Habitat (acres [ha])***
Finegayan cantonment	650.4 (263.2)
AAFB housing	8.2 (3.3)
Utility corridor specific to Alternative E	12.6 (5.1)
Utility corridors and water well areas common to Alternatives A-E	47.3 (19.1)
Total Recovery Habitat Impacted	**718.5 (290.8)**

Proposed construction activities would result in the loss of 795 acres (322 ha) of kingfisher recovery habitat on Guam. Although this loss of recovery habitat on Guam would not preclude the recovery of the kingfisher should it be reintroduced to Guam in the future, it would reduce the total number of kingfishers that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam Micronesian kingfisher.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the recovery of the Guam Micronesian kingfisher with implementation of Alternative E. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 780 acres [316 ha] of limestone forest) would be applicable for the kingfisher and its recovery habitat. In particular, the objectives of ungulate management, rodent control, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam Micronesian kingfisher, should it be reintroduced to Guam in the future.

As part of the ESA section 7 consultation process, the DON and the USFWS entered into a Memorandum of Agreement (MOA) which would, if the preferred alternative is chosen, facilitate kingfisher conservation goals. In the MOA, the DON agreed to designate approximately 5,234 acres (2,118 ha) under the custody and control of the DoD in northern Guam to a status that will provide durable habitat protection needed to support native habitat restoration and land management for the survival and recovery of the kingfisher. Consistent with the JRM INRMP developed in accordance with Section 101 of the Sikes Act, the DON agreed to actively restore native habitat and manage, in collaboration with the USFWS, the 5,234 acres (2,118 ha) consistent with the DoD's obligations under ESA section 7(a) and the Sikes Act to benefit the survival and recovery of the kingfisher. The DON would work cooperatively with the USFWS to identify, develop and implement specific management activities and projects on these 5,234 acres (2,118 ha) to support the reintroduction and recovery of the kingfisher.

These 5,234 acres (2,118 ha) have been identified by the USFWS as habitat for the kingfisher and needed to offset impacts of the proposed action. The DON and USFWS recognize that the designation of the 5,234 acres (2,118 ha) may also provide a conservation benefit to other ESA-listed species with similar habitat requirements (e.g., Mariana crow, Mariana fruit bat).

SEA TURTLES. The green and hawksbill sea turtles potentially nest along the Haputo ERA beach and along Tarague Beach to the west and north of the project areas, respectively (Figures 4.5.8-4 and 4.5.8-5). All cantonment and housing components would be constructed on the upper plateau area of Finegayan and AAFB and would not occur in the vicinity of any potential sea turtle nesting beaches. Construction personnel are issued base passes for official business only within proposed construction areas; these restrictions are specified in construction contracts. Use of Haputo ERA and Tarague Beach are not expected to increase as a result of construction activities; therefore, there would be no impacts from construction personnel to sea turtles that may occur on the Haputo ERA and Tarague Beach.

To avoid and minimize any potential impacts to nesting sea turtles from proposed facility lighting associated with the construction of the cantonment at Finegayan and family housing areas at AAFB, hooded lights would be used to the maximum extent practicable at all new roads and facilities near coastline areas. Illumination of coastline areas would be kept to an absolute minimum. The implementation of the potential mitigation measures described above under *Vegetation* (i.e., forest enhancement of 780 acres [316 ha] of limestone forest) would also benefit the survival of sea turtles. In particular, the objectives of ungulate management, control/suppression of invasive plants, outplanting of native species, and rodent control. Therefore, there would be no impacts to potential nesting sea turtles

within the Haputo ERA or Tarague Beach with implementation of the proposed construction activities associated with Alternative E.

TREE SNAILS. The three proposed endangered species of tree snails only occur within the Haputo ERA at Finegayan. All cantonment components would be constructed on the upper plateau area of Finegayan and would not occur in the Haputo ERA. Construction personnel are issued base passes for official business only within proposed construction areas; these restrictions are specified in construction contracts. Use of Haputo ERA is not expected to increase as a result of construction activities; therefore, there would be no impacts from construction personnel to tree snails that occur within the Haputo ERA. Therefore, there would be no impacts to tree snails occurring within the Haputo ERA with implementation of the proposed construction activities associated with Alternative E.

The implementation of the potential forest enhancement mitigation measures described above for the Mariana crow would also benefit the survival of tree snails. In particular, the objectives of ungulate management, rodent control, control/suppression of invasive plants, and outplanting of native species.

MARIANA EIGHT-SPOT BUTTERFLY. The Mariana eight-spot butterfly or its two known host plant species have not been reported within the proposed project areas at Finegayan and AAFB. However, given the proximity of the eight-spot butterfly area to Finegayan (see Figure 4.5.8-4) and the high mobility of the species, the species is likely to occur within the larger Finegayan and AAFB areas.

Some species of tropical butterflies have well-developed ears on their wings and can detect sounds at the same frequencies that humans can hear. It is hypothesized that the butterflies are listening to the flight sounds or foraging calls of predatory birds (Lane *et al.* 2008; Yack 2012). Given the low numbers of forest birds currently on Guam due to the brown treesnake, masking of the flight sounds or foraging calls of predatory birds due to noise from proposed construction activities would not make eight-spot butterflies more susceptible to predation.

With implementation of appropriate BMPs to avoid and minimize potential impacts to eight-spot butterflies (e.g., pre-construction butterfly and host plant surveys within the proposed construction footprint and salvage/relocation of host plants, larvae or eggs; see Section 2.8), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed construction activities associated with Alternative E. In addition, implementation of the potential mitigation measures described above under *Vegetation* (i.e., forest enhancement of 780 acres [316 ha] of limestone forest) would also benefit the survival the eight-spot butterfly. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species, including eight-spot butterfly host plants.

SERIANTHES TREE. Although individual *Serianthes* trees do not occur within the impacted areas of Alternative E, approximately 648 acres (262 ha) of *Serianthes* recovery habitat would be removed due to proposed construction activities at Finegayan and AAFB under Alternative E (Table 4.5.8-8). This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 4.5.8-8. Summary of Permanent Construction-Related Impacts to *Serianthes* Recovery Habitat with Implementation of Cantonment/Family Housing Alternative E

Project Component	*Recovery Habitat (acres [ha])*
Finegayan cantonment	587.0 (237.6)
AAFB housing	10.8 (4.4)
Utility corridor specific to Alternative E	11.0 (4.4)
Utility corridors and water well areas common to Alternatives A-E	39.2 (15.9)
Total Recovery Habitat Impacted	**648.0 (262.2)**

Although this loss of recovery habitat would not preclude the recovery of *Serianthes* on Guam, given the loss of *Serianthes* recovery habitat, there would be significant but mitigable impacts to the recovery of *Serianthes* on Guam.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of *Serianthes* with implementation of Alternative E. Final mitigation measures would be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, Vegetation for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 780 acres [316 ha] of limestone forest) would be applicable for *Serianthes* recovery habitat. In particular, the objectives of ungulate management, rodent control, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for *Serianthes*. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

TABERNAEMONTANA ROTENSIS. Approximately four clusters of the SOGCN T. rotensis are located within the Alternative E impacted areas, primarily within or adjacent to the proposed utility corridors on AAFB (see Figure 4.5.8-2). Under Alternative E, all *T. rotensis* would be avoided to the maximum extent practicable during proposed construction activities. In addition, high-value (both biologically and culturally) plant species such as *T. rotensis* seedlings and saplings could be salvaged during construction activities and translocated to suitable habitat on AAFB (see Section 2.8). Therefore, with implementation of these BMPs (e.g., avoidance, or salvage and translocation), there would be less than significant impacts to *T. rotensis* with implementation of the proposed construction activities associated with Alternative E.

CYCAS MICRONESICA. There are no known *C. micronesica* within the proposed impacted areas associated with Alternative E. With implementation of appropriate BMPs to avoid and minimize potential impacts to cycads (e.g., pre-construction surveys within the proposed construction footprint and salvage/relocation of

plants), there would be less than significant impacts to *C. micronesica* with implementation of proposed construction activities associated with Alternative E.

DENDROBIUM GUAMENSE AND *TUBEROLABIUM GUAMENSE*. There is a known single occurrence of each species within the northeastern portion of Finegayan. Both species would be salvaged to the maximum extent practicable and translocated to suitable habitat (see Section 2.8). With the implementation of BMPs, such as potential translocation of *D. guamense* and *T. guamense* to suitable habitat, there would be less than significant impacts to both species with implementation of the construction activities associated with Alternative E. In addition, the implementation of the potential mitigation measures under the *Vegetation* section above would also benefit the survival of these orchid species. In particular ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

Special-Status Species: Guam-Listed and SOGCN

MICRONESIAN STARLING. The Micronesian starling is present in an existing housing area (see Figure 4.5.8-5) that would be redeveloped to accommodate the new housing area on AAFB. During proposed construction and demolition activities, some Micronesian starlings would relocate to other suitable areas on AAFB, particularly to the north and south of the proposed family housing area. To the maximum extent practicable, the mature palm trees that starlings use for nesting and roosting within the existing housing area would not be removed during the proposed construction activities. Construction and demolition would also occur in phases, thereby not impacting the entire starling population within the existing housing area at one time. After construction, starlings could return to the new cantonment/family housing area. It is also expected that the new cantonment/family housing area may potentially increase the area of suitable habitat on AAFB by increasing potential nesting habitat (i.e., man-made structures, palm trees, areas with brown treesnake control). Therefore, as the loss of a portion of existing Micronesian starling habitat on AAFB would be temporary and there would be an increase in starling habitat during and after construction, there would be less than significant impacts to the Micronesian starling with implementation of proposed construction activities associated with Alternative E.

WHITE-THROATED GROUND DOVE. Although considered extirpated from Guam since the 1980s, the white-throated ground dove has been observed on AAFB on rare occasions (JRM *et al.* 2012a, 2012b; NAVFAC Marianas 2013b). The primary cause of its extirpation and lack of reestablishment on Guam is due to predation by the brown treesnake (GDAWR 2006). It has not been reported in the proposed impacted areas associated with Alternative E, only in other areas on AAFB including the MSA and the southeastern corner of AAFB. Therefore, there would be no impacts to the white-throated ground dove with implementation of the construction activities associated with Alternative E.

MOTH SKINK AND PACIFIC SLENDER-TOED GECKO. The moth skink and Pacific slender-toed gecko were detected in northeastern corner of Finegayan and within a proposed utility corridor along the south-central area of AAFB within secondary limestone forest that would be directly impacted under Alternative E (see Figures 4.5.8-4 and 4.5.8-5). Construction activities associated with Alternative E would result in the loss of approximately 857 acres (347 ha) of occupied limestone forest habitat for both the skink and gecko. This loss of occupied limestone forest habitat for both the skink and gecko would be a significant but mitigable impact.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct long-term impacts of proposed construction activities on the moth skink and

slender-toed gecko with implementation of Alternative E. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, Vegetation for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

The potential forest enhancement mitigation measures described above in the *Vegetation* section would also result in a conservation benefit to the moth skink and slender-toed gecko. The proposed brown treesnake research and suppression measures discussed above under the Mariana crow may also benefit the skink and gecko. See the potential mitigation discussions for the Mariana crow, Micronesian kingfisher, and the Guam rail for more information. No additional impacts to other Guam-listed species and SOGCN from construction beyond those previously described for Alternative A (see Section 4.1.8.2) would occur under Alternative E. Therefore, there would be less than significant impacts to Guam-listed species and SOGCN with implementation of proposed construction activities associated with Alternative E.

Operation

Operational impacts would only occur for the proposed cantonment at Finegayan and housing at AAFB. Operational requirements for the proposed utilities would require only periodic, limited maintenance activities along established utility corridors and impacts to biological resources would be less than significant. Consequently, only the potential operational impacts at the proposed Finegayan cantonment and AAFB housing area are evaluated below.

Vegetation. With implementation of BMPs and potential mitigation measures (see Section 2.8), including invasive species outreach and education, ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species, and applicable elements of the SIP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the cantonment and housing area under Alternative E is considered unlikely. Therefore, there would be less than significant impacts to vegetation with operation of the proposed cantonment at Finegayan and housing area at AAFB under Alternative E.

Terrestrial Conservation Areas. After construction of the cantonment and housing areas under Alternative E, approximately half of the remaining designated Overlay Refuge area on Finegayan would be developed, while the majority of remaining designated Overlay Refuge lands on AAFB would remain undeveloped. Therefore, operational activities of the cantonment under Alternative E are expected to result in less than significant impacts to the remaining Overlay Refuge lands on Finegayan and there would be no impact to Overlay Refuge lands with operation of the proposed housing area at AAFB.

All cantonment components would be located on the upper plateau area of Finegayan and not within the Haputo ERA. However, potential increased usage of the Haputo ERA by military and civilian personnel

associated with the proposed cantonment and housing facilities at Finegayan would result in significant but mitigable impacts to the Haputo ERA. The following potential mitigation measures may be implemented to mitigate potential direct, long-term impacts of proposed operational activities on the Haputo ERA with implementation of Alternative E.

Potential Mitigation Measures

The following measures may be implemented to mitigate potential direct, long-term impacts of proposed operational activities on the Haputo ERA with implementation of Alternative E.

- Fencing of the Haputo ERA access trail to control and manage access.
- Development and installation of informational and educational signage.
- Development of educational materials for military and civilian personnel on the sensitive biological resources within the Haputo ERA.
- Monitoring of visitor use.

An ERA is established to conserve and protect characteristic or outstanding botanical, ecological, geological, and scenic features or processes and where current natural conditions are maintained. These conditions are ordinarily achieved by allowing natural, physical, and biological processes to prevail without human intervention. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent overuse and potential damage to terrestrial biological resources. These measures are consistent with the goals and objectives of the Haputo ERA Management Plan (NAVFAC Marianas 2010).

Wildlife - Native Species. Potential impacts to wildlife were evaluated in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-101) for a similar proposed action but impacting a larger area, and were found to be less than significant.

No additional impacts to native wildlife species from operations at Finegayan beyond those previously described for Alternative A (see Section 4.1.8.2) would occur under Alternative E. Lighting along the perimeter of the cantonment and housing areas would be hooded or shielded to the maximum extent practicable to prevent unnecessary light beyond operational areas. Proposed operational activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. To prevent the inadvertent spread of non-native species on Guam or to other locations off of Guam, the DON would implement standard biosecurity measures (e.g., brown treesnake interdiction measures, outreach/education, and 1-year post-construction monitoring to evaluate effectiveness of HACCP) into operational procedures and activities. Therefore, there would be less than significant impacts to wildlife due to proposed operation of the cantonment and housing areas under Alternative E.

However, the following BMPs would be implemented to avoid and minimize potential indirect, long-term impacts of proposed operational activities on native wildlife with implementation of Alternative E.

Best Management Practices

- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.
- *Prevention of Free-Roaming Cats and Dogs*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of DON policies regarding free-roaming cats and dogs.

With implementation of these BMPs, including ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the risk of the introduction and establishment of new or spread of existing non-native species on Guam is substantially reduced.

Continued implementation of the potential mitigation measures under the Construction, *Vegetation* and *Special-status Species* sections above would also benefit native wildlife species and habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species. The implementation of the potential mitigation measures under the *Terrestrial Conservation Areas* section above would also benefit native wildlife species. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to native wildlife species within the Haputo ERA. Therefore, there would be less than significant impacts to native wildlife species related to the introduction and establishment of non-native species due to operational activities associated with Alternative E.

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. Potential impacts to the Mariana fruit bat from operational activities are based on the distances from operations that are likely to cause disturbance to this species (e.g., noise, lighting, and general human disturbance). These are the same distances that were previously discussed for construction impacts. This area of fruit bat recovery habitat would continue to be impacted from operational activities of the cantonment area at Finegayan and housing area at AAFB after construction activities have ceased.

Operation of the proposed cantonment and housing areas under Alternative E would result in significant but mitigable impacts to fruit bats due to potential direct disturbance (e.g., noise, lighting, and general human disturbance) to fruit bats within 150-m of the cantonment/family housing area. The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential long-term impacts of proposed operational activities on the Mariana fruit bat with implementation of Alternative E.

Best Management Practices

- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.
- With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, 1-year post construction monitoring to evaluate effectiveness of HACCP, and applicable elements of the SIP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the proposed cantonment/family housing under Alternative E is considered unlikely.

Potential Mitigation Measures

- Continued implementation of the potential mitigation measures under the Construction, *Vegetation* and *Special-status Species* sections above would also benefit the Mariana fruit bat and recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species. The implementation of the potential mitigation measures

under the Terrestrial Conservation Areas section above would also benefit the fruit bat and recovery habitat. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to fruit bats within the Haputo ERA.

MARIANA CROW, GUAM RAIL, AND GUAM MICRONESIAN KINGFISHER. These species are extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of these species is reasonably certain to occur and the species are likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of these species, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow, rail, and kingfisher are successfully re-introduced and then have the potential to be exposed to cantonment and housing operational activities under Alternative B, there would be no impact to these species. If the species are reintroduced and exposed to cantonment and housing operational activities under Alternative E, they may be disturbed.

SEA TURTLES. Potential impacts to sea turtles were evaluated for a similar, but larger, proposed action in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, NCTS and South Finegayan; page 10-118), and were found to be less than significant and would continue to be less than significant with implementation of Alternative E.

As discussed previously under construction impacts, to avoid and minimize any potential impacts to nesting and potential hatchling sea turtles from proposed facility lighting at Finegayan and AAFB, hooded lights would be used to the maximum extent practicable at all new roads and facilities near coastline areas. Illumination of coastline areas would be kept to an absolute minimum.

Increased recreational use of Tarague Beach by military and civilian personnel associated with the proposed housing facilities at AAFB could potentially impact sea turtles using the beach and nearshore waters. The implementation of the potential mitigation measures under the Construction, Vegetation and Terrestrial Conservation Areas sections above would benefit the survival of sea turtles (e.g., reducing erosion, reducing nest predation by rodents). In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Free-roaming pets are not permitted on DON installations. All pets must be either kept indoors or, when outside, on a leash and collar or within a cage or fenced yard. This policy would prevent potential impacts to nesting sea turtles from harassment, injury or mortality from free-roaming pets. Pets are not permitted in the Haputo ERA. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to nesting sea turtles that may potentially use Haputo Beach.

Given the low probability of sea turtle nesting at Haputo Beach combined with implementation of potential mitigation measures for Vegetation, Terrestrial Conservation Areas and Wildlife-Native Species, impacts resulting from the proposed action would be less than significant to nesting sea turtles at Haputo Beach within the Haputo ERA and Tarague Beach with implementation of the operational activities associated with Alternative E.

MARIANA EIGHT-SPOT BUTTERFLY. The Mariana eight-spot butterfly and its host plants are known to occur within the Haputo ERA, but not within the impacted areas of Finegayan or the housing area on AAFB (see Figure 4.5.8-4). With the exception of periodic fence maintenance in the northern portion of

Haputo ERA near the known butterfly area, there would be no operational impacts to butterflies or host plants with implementation of Alternative E.

TREE SNAILS. Three species of proposed endangered tree snails are present along the coast in the Haputo ERA. Potential impacts to tree snails at Haputo ERA were evaluated for a similar, but larger proposed action in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-118). Potential impacts to tree snails at the Haputo ERA due to operations associated with Alternative E would be less than significant. Implementation of the potential mitigation measures discussed below would provide additional benefits to tree snails.

The implementation of the potential mitigation measures under the *Vegetation* and *Terrestrial Conservation Areas* sections above would also benefit tree snails. In particular, the objectives of ungulate management, rodent control, control/suppression of invasive plants, and outplanting of native species proposed under the potential forest enhancement mitigation measures. There is the potential for impacts to tree snails within the Haputo ERA from disturbance of vegetation and collecting and handling of tree snails due to increased usage of the ERA by military and civilian personnel associated with the proposed cantonment and housing facilities at Finegayan. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to tree snail species and their habitat within the Haputo ERA.

TABERNAEMONTANA ROTENSIS AND CYCAS MICRONESICA. There would be no impacts to *T. rotensis* and *C. micronesica* due to operations associated with Alternative E. The implementation of the potential mitigation measures under the *Terrestrial Conservation Areas* section above would also benefit special-status plant species. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to special-status plant species within the Haputo ERA.

DENDROBIUM GUAMENSE AND *TUBEROLABIUM GUAMENSE*. After proposed construction of Alternative E facilities and infrastructure, there would be no known occurrences of either species within Finegayan or AAFB support areas associated with Alternative E. Therefore, there would be no impacts to both species with implementation of Alternative E operations.

Special-Status Species: Guam-Listed and SOGCN

No additional impacts to Guam-listed species and SOGCN from operations beyond those described for Alternatives A and C would occur under Alternative E. There would be no impacts to the moth skink or slender-toed gecko due to operations associated with Alternative E. The implementation of the potential mitigation measures under the *Terrestrial Conservation Areas* section above would also benefit the skink and gecko. Fencing to manage access would assist in maintaining the characteristics and integrity of the Haputo ERA and would prevent potential disturbance to these species and their habitat within the Haputo ERA.

Micronesian starlings are adapted to human presence and associated activities based on their ability to nest and forage in housing areas. Therefore, there would be no operational impacts to starlings under Alternative E.

Although considered extirpated from Guam, the white-throated ground dove is observed on AAFB on rare occasions (JRM *et al.* 2012a, 2012b; NAVFAC Marianas 2013b). The white-throated ground dove has not been reported in the Alternative E impacted areas. Therefore, there would be no impacts to the white-throated ground dove due to operations associated with Alternative E.

Therefore, there would be less than significant impacts to Guam-listed species and SOGCN with the operation of the cantonment area at Finegayan and family housing area at AAFB under Alternative E.

4.5.9 Marine Biological Resources

4.5.9.1 Affected Environment

Under Alternative E, the affected environment for marine biological resources is as described for Alternative A (Section 4.1.9) and Alternative C (Section 4.3.9). In addition, an extensive discussion of the affected environment for marine biological resources surrounding Guam is provided in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1: Affected Environment, pages 11-1 to 11-68). Under Alternative E, the family housing would be constructed at AAFB in existing disturbed areas and would be further away from the coast than the family housing location under Alternative A. The cantonment at Finegayan would be located at the same location as for Alternative A.

4.5.9.2 Environmental Consequences

The environmental consequences for marine biological resources in the vicinity of Alternative E would be similar to those previously described for Alternatives A and C in Sections 4.1.9.2 and 4.3.9.2, respectively. Because the family housing under Alternative E would be located inland at AAFB and not in proximity to any recreational beaches (e.g., Haputo Beach) compared to Alternative A, the potential for any impact to marine biological resources would be reduced during construction and operation. The only anticipated indirect impact to all marine biological resources from project operations is associated with temporary increased wastewater discharge from the Northern District WWTP. Mitigation to address this impact would be the same for Alternative E as described for Alternative A in Section 4.1.9.2. With such mitigation, the impact to marine biological resources via water quality could be beneficial in the long-term because wastewater discharge from the Northern District WWTP would improve over existing conditions with treatment system upgrades. However, during the interim period of change when the effluent discharged from the Northern District WWTP would continue to not meet Guam Water Quality Standards, the proposed action may indirectly impact marine biological resources via water quality, but effects would be temporary and less than significant as described for Alternatives A and C in Sections 4.1.9.2 and 4.3.9.2, respectively.

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act, the DON initiated informal consultation with the NOAA's NMFS Pacific Islands Regional Office, Habitat Conservation Division in May 2014 to determine the potential effects of construction and operations of DON's preferred alternatives (Alternatives E and 5) on EFH. NMFS reviewed the 2014 Draft SEIS on Guam and CNMI Military Relocation (2012 Roadmap Adjustments) and supplementary information provided by the DON during the course of the EFH consultation.

NMFS determined that adverse effects to EFH would occur unless recommended conservation measures were implemented. NMFS identified seven conservation recommendations to avoid and minimize impacts to EFH. The NMFS EFH effects determination letter of April 27, 2015 containing the complete list of recommendations and the DON's response to the determination letter are located in Vol. 2 Appendix F.5. NMFS' recommended conservation measures are summarized below.

- The DON should commit to ensure that the Northern District WWTP is upgraded to meet Guam Water Quality Standards (GWQS) with an emphasis on orthophosphate, nitrate-nitrogen, and ammonia concentrations. The DON should encourage GWA to reduce nutrient levels even further as the GWQS are still above recommended levels of nitrate and orthophosphate discharges for coral reef habitats.

- The DON should, to the greatest extent practicable, minimize stormwater runoff and prevent increases in the amount of water discharged through freshwater seeps into nearshore coastal waters for each project component.
- The DON should further examine the fate of stormwater for these project components, particularly the Finegayan Cantonment and NWF LFTRC, to determine whether stormwater practices affect sensitive nearshore reefs such as the HAPCs at Haputo ERA and the Ritidian Unit of the Guam NWR through seeps.
- The ROD should clearly identify funding and provide minimal guidelines for programs to minimize impacts from training, recreation, and fishing activities for Marine Corps personnel.
- Ensure that each Marine Corps unit assigned to Guam irrespective of duration and deployment status will institute a physical training awareness and operational guidance that identifies appropriate physical training areas as well as identify sensitive areas that are off-limits for such activities in coordination with installation and regional resource management plans.
- Develop methods to minimize fishing impacts by reducing take of fish species from key functional groups and rare species. This could include a ban for DoD personnel on use of destructive methods of fishing including for species of local concern such as humphead wrasse and green humphead parrotfish.
- The DON should provide a commitment to develop and implement a detailed and comprehensive Adaptive Management Plan that defines watershed management and erosion control mechanisms that will be adopted based on current best available information and involve a protocol articulating the framework to include assessing and mitigating cumulative impacts.

On December 10, 2014, pursuant to section 7(a)(2) of the ESA, the DON requested informal consultation with NMFS Pacific Islands Regional Office regarding the effects of the proposed action on ESA-listed marine species: the threatened scalloped hammerhead shark and four species of threatened coral (*Acropora globiceps*, *Acropora retusa*, *Pavona diffluens*, and *Seriatopora aculeata*). Based on further consultation with NMFS, the DON determined that only three of these recently listed coral species could occur in the vicinity of the proposed action (*Acropora globiceps*, *Acropora retusa*, and *Seriatopora aculeata*) and accordingly, the DON requested informal consultation to address potential effects to these three recently listed species.

The DON requested informal consultation for two separate proposed action elements, which may have the potential to affect the scalloped hammerhead shark and the three species of threatened coral identified above:

- The effects of the projected increase of effluent from the Northern District WWTP outfall, a GWA facility.
- The effects of constructing the Amphibious Vehicle Laydown Area (AVLA) in Inner Apra Harbor.

The DON determined that the projected increase of effluent from the Northern District WWTP outfall may affect, but is not likely to adversely affect *Acropora globiceps*, *Acropora retusa*, and *Seriatopora aculeata*, and the scalloped hammerhead shark because the effects are insignificant.

The AVLA includes a vehicle ramp which is the only in-water project not completed from the original 2010 EIS and associated ESA section 7 consultation with NMFS. The DON determined that the AVLA project may affect, but is not likely to adversely affect the scalloped hammerhead shark, because the effects are discountable. At the request of NMFS, on April 13, 2015 the DON provided additional detailed information about the proposed action and potential conservation and mitigation measures (see

Appendix F.5). Consultation with NMFS concluded with a letter of concurrence on May 18, 2015 (see Appendix F.5). NMFS considered the information in the DON's EIS/OEIS (2010), the Draft SEIS (2014), and consultation requests, as well as the best scientific information available about the biology and expected behaviors of the ESA-listed marine species and agreed with the DON conclusion that the proposed action is not likely to adversely affect the scalloped hammerhead shark or the ESA-listed corals.

NMFS also agreed that the proposed action would have no effect on critical habitat. NMFS provided in their letter of concurrence five conservation recommendations that they deemed prudent. The DON will consider adoption of one or more of these conservation recommendations and will address them in the ROD for this proposed action.

4.5.10 Cultural Resources

4.5.10.1 Affected Environment

The following discussion summarizes previous cultural resources studies and known historic properties and other cultural resources within the area of potential cultural resource impacts associated with Alternative E. The discussion below addresses historic properties, as defined in the NHPA, and resources of cultural importance as defined under NEPA. The discussion refers to the terms direct effects and indirect effects to historic properties as defined under the NHPA, and impacts to other cultural resources as defined under NEPA (see Section 3.10.3.2). The section is organized to address cultural resources for the cantonment/family housing, followed by discussion of the same resource types for off-site utilities and school expansions associated with this alternative. If this alternative is selected for implementation, the information presented here would be augmented by reviews consistent with the 2011 PA, which provides overall NHPA Section 106 compliance and addresses other cultural resource issues. Refer to Section 3.10 for a detailed description of the 2011 PA. Additionally, some built properties in this section are covered by Program Comments executed by the ACHP, which resolve Section 106 responsibilities for certain DoD facilities. See Chapter 3, Section 3.10 for more information on definitions and procedures.

Alternative E is located in two locations on the northern portion of Guam: Finegayan and AAFB. The cantonment area of Alternative E includes the same area as the proposed cantonment for Alternative A. The housing area for Alternative E would be located at the current AAFB family housing area as discussed under Alternative C.

Located on the northwestern side of Guam, Finegayan is a telecommunications installation that was first established during the 1950s. The installation includes radio frequency systems and terrestrial-based fiber optic cables. Alternative E would construct and operate administrative facilities and associated utilities (see Figure 2.4-13 in Chapter 2 of this SEIS) for the cantonment.

AAFB is located on the northern plateau area of Guam. It includes the main active airfield and an array of operations, maintenance, and community support facilities. The central third of the installation is a MSA. The western third is NWF, a WWII-era airfield used for fixed-wing aircraft and helicopter training and various field exercises and bivouacs. Alternative E would construct and operate administrative and housing areas, community support facilities (e.g., schools, child development center, community center), and associated utilities (see Figure 2.4-13 in Chapter 2 of this SEIS).

The affected environment for cultural resources associated with Alternative E is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 12: Cultural Resources, Section 12.1.2.2: Finegayan, pages 12-16 to 12-19 and Volume 2, Chapter 12: Cultural Resources, Section 12.1.2.1: Andersen AFB, pages 12-9 to 12-16), which were based on surveys of the PDIAs completed at that time. The description of the affected environment provided here has been updated with new information from recent archaeological and architectural investigations supporting other projects. To determine whether information is from an existing reference (such as the 2010 Final EIS or other cultural resource studies) or collected during in-fill studies conducted in support of this SEIS, refer to dates in the reference column in each table for the archaeological sites. Information for the architectural resources was derived from the internet Navy Facilities Asset Data Store (iNFADS).

Surveys conducted to support the 2010 Final EIS included the PDIA for Alternative E. Those previous investigations included intensive archaeological surveys (Athens 2009; Welch 2010), architectural inventories (Welch 2010; SEARCH 2013), potential TCP studies (Griffin *et al.* 2010), and oral histories (Welch 2010). In addition to these surveys and other past surveys (Grant *et al.* 2007), an intensive archaeological survey of 993 acres (402 ha) and an architectural inventory was conducted for this SEIS (Dixon *et al.* 2014). The previous investigations provide a comprehensive inventory of cultural resources and TCPs occurring within the Alternative E PDIA.

On-site utility corridors associated with Alternative E would be located along the southern boundary of AAFB adjacent to Route 9 (see Figure 2.4-13) and along Route 3 east of Finegayan. Intensive archaeological surveys of the proposed utility line impacted area on AAFB were conducted in 2004 (Yee *et al.* 2004), 2008 (Athens 2009) and 2010 (Dixon and Walker 2011).

All cantonment/housing alternatives would include construction of off-site utilities along Routes 1, 3, and 9, a water well field at AAFB, and expansion or construction of two schools at Naval Base Guam and AAFB (see Figure 2.4-14). Assessments of potential impacts to cultural resources from construction of utilities along road right-of-ways are based on a reconnaissance survey of portions of the area in 2010 (Dixon *et al.* 2011b) and a literature review of previous surveys and historic development in the area. Assessments of impacts to cultural resources from the development of a water well field and from the two school expansions are based on in-fill surveys conducted in support of this SEIS (Dixon *et al.* 2014).

Based on data from previous surveys of the proposed cantonment/family housing area, and utility corridor impacted areas, Table 4.5.10-1 lists 16 known archaeological sites located within PDIA for Alternative E. Of the 16 sites, 7 are considered eligible for listing in the NRHP and include 4 Pre-Contact/Latte Period artifact/ceramic scatters, 1 Pre-Contact/Latte Period habitation site, and 2 historic/First and Second American Administration sites. Nine sites ineligible for listing are comprised of disturbed WWII encampments and Pre-Contact/Latte Period pottery scatter.

Table 4.5.10-1. Archaeological Sites within the Finegayan Cantonment/AAFB Family Housing Alternative

GHPI Number	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-1350***	1029*	Water catchment structure	First American Territorial	Welch 2010	Yes	D
66-08-2293	NF1	Concrete foundations, concrete curbed pit, artifact scatters	Post-WWII/Second American Territorial	Athens 2009	No	NA
66-08-2294	NF2	Concrete pads and slabs	Post-WWII/Second American Territorial	Athens 2009	No	NA
66-08-2295	NF3	Artifact scatter	Pre-Contact/Latte	Athens 2009	No	NA
66-08-2296	NF4	Artifact scatter	Pre-Contact/Latte	Athens 2009	No	NA
66-08-2297	NF5	Artifact scatter	Pre-Contact/Latte	Athens 2009	No	NA
66-08-2298	NF6	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-08-2302***	ANT-2/1025*	Encampment	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-08-2303***	ANT-3/1026*	Habitation site, artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	NA
66-08-2304***	ANT-5/1027*	Encampment	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-08-2305	ANT-6/1028*	Encampment	Post-WWII/Second American Territorial	Welch 2010	Yes	D
66-08-2306***	ANT-8/1030*	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2307***	ANT-9/1033*	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2308***	ANT-10/1034*	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2309***	ANT-11/1035*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	D
66-08-2701	T-1/378*	Ceramic scatter	Pre-Contact/Latte	Haun 1988	Yes	D

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable. NRHP criterion D = eligible for potential to yield information important in prehistory or history.

Notes:*Map numbers are from Welch *et al.* (2009) and Welch (2010).

** Revised to match Guam GHPI forms dated May 28, 2014.

***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2, 2014 [RC2013-0853]).

Two NRHP-eligible archaeological sites, located on AAFB, have been identified within the PDIA for Alternative E on-site utility corridors (see Figure 2.4-5; Table 4.5.10-2). However, data recovery for both sites has been performed as mitigation for a previous project (Eakin *et al.* 2012). No TCPs have been identified in the PDIA for this alternative.

Table 4.5.10-2. Archaeological Sites within the Finegayan Cantonment/AAFB Family Housing Alternative Onsite Utilities PDIA

GHPI Number	*Temporary Site Number/ Map Number*	*Site Type*	*Period*	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-2551***	T-W-4	Historic farmstead	Post-WWII/ Second American Territorial	Dixon and Walker 2011	Yes*	D
66-08-2552***	T-W-7	Artifact scatter	Pre-Contact/Latte	Dixon and Walker 2011	Yes*	D

Legend: NRHP criterion D = eligible for potential to yield information important in prehistory or history.
Note: *Data recovery excavations were conducted at both sites (Eakin *et al.* 2012), which determined that neither site had an intact subsurface cultural deposit.
** Revised to match Guam GHPI forms dated May 28, 2014.
***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2, 2014 [RC2013-0853]).

There are 974 architectural properties, constructed between 1953 and 2008, within the PDIA for Alternative E (Table 4.5.10-3). These buildings and structures include barracks, administrative facilities, and recreational facilities. Thirty-nine buildings are bachelor housing covered under the Program Comment for Cold War Era Unaccompanied Personnel Housing (ACHP 2006; see Chapter 3.10.3 for more information on the Program Comments). A total of 766 buildings are family housing and are covered under the Program Comment for Wherry and Capehart Era Family Housing at Air Force and Navy Bases (ACHP 2004). Seventeen buildings are housing support facilities, including garages and other facilities, all of which are covered under the Program Comment for Wherry and Capehart Era Family Housing at Air Force and Navy Bases (ACHP 2004). Four buildings and structures are support facilities (recreational and hydrologic facilities) that are greater than 50 years in age that have not been evaluated. Five wells and three buildings of unknown age have also not been evaluated for NRHP-eligibility. If Alternative E were selected, any unevaluated properties would be evaluated under the procedures identified in the 2011 PA. One-hundred and thirty-eight buildings have been determined ineligible for listing in the NRHP, including 74 buildings that are less than 50 years old and do not meet the exceptional significance threshold required under NRHP Criteria Consideration G. The 2011 PA includes procedures for the identification of historic properties, as specific projects are developed, through consultation with the Guam SHPO and the public.

Certain off-site utility improvements are common to all of the cantonment/family housing alternatives. In addition to the cantonment/family housing and utility corridor areas, Alternative E would include construction of off-site utilities, a water well field, and expansion or construction of two schools. One site, T-H-1, is within the off-site utility corridor. This site is not eligible for listing in the NRHP. No architectural properties or TCPs have been identified within the off-site utilities PDIA.

In addition to the cantonment/family housing and utility corridor areas, Alternative E would include construction of off-site utilities, a water well field, and expansion or construction of two schools. Nine NRHP-eligible archaeological sites and 15 sites not considered eligible for listing in the NRHP have been identified in these areas (see Alternative A, Table 4.1.10-4 and 4.1.10-5). As under Alternative A, one structure within the well development area on AAFB is eligible for listing in the NRHP, four structures are not eligible, and six structures are unevaluated. (No architectural properties or TCPs have been identified within the off-site utilities potential impacted area).

Table 4.5.10-3. Summary of Architectural Properties Located within the Finegayan Cantonment/AAFB Family Housing Alternative PDIA

Building/Structure Type	*Location*	*Number of Buildings/ Structures of this Type in Potentially Impacted Area*	*Date of Construction*	*NRHP Eligible?*
Housing Facilities for Unaccompanied Personnel (barracks)	Finegayan	37	1954 to 1968	Covered under Program Comment
Ancillary Housing Facilities (garages)	Finegayan	13	1954 to 1962	Covered under Program Comment
Housing Support Facilities	Finegayan	4	1954 to 1955	Covered under Program Comment
Family Housing	AAFB	766	1956 to 1963	Covered under Program Comment
Unaccompanied Personnel Housing (barracks)	AAFB	2	1956	Covered under Program Comment
Support Facilities				
Recreational Facilities	Finegayan	1	1963	Not Evaluated
Hydrologic Support Facilities	Finegayan	2	1954 to 1965	Not Evaluated
Wells	Finegayan	5	Unknown	Not Evaluated
Pavilions/Bus Stop/Shelters	Finegayan	33	1961 (n=1); Unknown (n=32)	No
Unknown	Finegayan	1	Unknown	Not Evaluated
Administrative, utilities, recreation, training, and support facilities	Finegayan	26	1953 to 1965	No
Administrative, utilities, recreation, and support facilities	Finegayan	24	1966 to 1994	No
Sewer Lift Station	AAFB	1	1960	Not Evaluated
Well AF-1	AAFB	1	Unknown	Not Evaluated
Gatehouse	AAFB	1	1964	Yes
Firehouse	AAFB	1	1955	Yes
Maintenance, support, recreation, and supply facilities	AAFB	37	1963 to 2008	No
Pavilions/Bus Shelters	AAFB	13	1987 to 1993	No
Billboards, Signs, Marquees	AAFB	5	2006 to 2009	No
Overwatch	AAFB	1	Unknown	Not Evaluated

Note: Information on type, number, and date of construction from iNFADS.

Under Alternative E, the Andersen Middle School facility would be repurposed as an elementary school and expanded at its current site, and a new middle school would be constructed. This area is within the AAFB cantonment/family housing potential direct impacted area. The expansion of the DoDEA High School would involve construction at the Naval Hospital site in central Guam. No NRHP-eligible sites, architectural properties, or TCPs have been recorded in this area.

4.5.10.2 Environmental Consequences

Construction

Construction activities associated with Alternative E may adversely affect historic properties. Final determinations of effect would occur under the 2011 PA. Following is a discussion of potential adverse effects for purposes of this analysis. Excavation and soil removal associated with buildings and on-site utility construction could adversely affect seven known NRHP-eligible archaeological sites, including Pre-Contact/Latte Period artifact scatters and other sites (see Table 4.5.10-1 and Table 4.5.10-2). In addition, two of sites (GHPI Numbers 66-08-2551 and 66-08-2552) have been previously mitigated via archaeological data recovery conducted in consultation with SHPO (Eakin *et al.* 2012).

Construction at Finegayan would also require the demolition of 24 buildings (see Table 4.1.10-7). Of these 24 buildings in the PDIA, 16 are covered under the *Program Comment for Cold War Era Unaccompanied Personnel Housing* (ACHP 2006), 7 are not eligible, and 1 (facility number 209) is not evaluated. Consistent with the 2011 PA, final determinations of eligibility, including the one unevaluated property, and assessment of effect would be completed in conjunction with project-specific reviews, if this alternative is selected.

Construction at AAFB would also require the demolition of 832 buildings (Table 4.5.10-4). Of these 832 buildings and structures, two buildings are covered under the *Program Comment for Cold War Era Unaccompanied Personnel Housing* (ACHP 2006), and 766 are covered under the *Program Comment for Wherry and Capehart Era Family Housing at Air Force and Navy Bases* (ACHP 2004). Fifty-eight buildings and structures are not eligible, and seven are unevaluated.

Table 4.5.10-4. Architectural Properties to be Demolished within the Finegayan Cantonment/AAFB Family Housing Alternative PDIA

Building Name or Type	*Location*	*Facility Number(s)*	*Date of Construction*	*NRHP Eligible?*
Andersen Softball Field	Finegayan	159	1965	No
Public Quarters Junior Officer	Finegayan	173, 175, 185, 187, 188, 189, 191, 192, 193, 194, C190	1955	Covered under Program Comment
Public Quarters Enlisted	Finegayan	C202, C203, C204, C205	1963	Covered under Program Comment
Public Quarters - CO	Finegayan	197	1966	Covered under Program Comment
CDAA Building/Standby Generator 350 KW	Finegayan	200	1964	No
CDAA Building/Standby Generator 350 KW	Finegayan	204	1972	No
Swimming Pool Bathhouse	Finegayan	209	1963	Not Evaluated
NEX Storage Warehouse	Finegayan	305	1973	No
CDAA Chill Water Plant	Finegayan	335	1978	No
Bus Stop Shelter	Finegayan	387	Unknown	No
Swimming Pool Pavilion	Finegayan	498	1987	No
Administration or Support	AAFB	2403,9000, 9002	1954 to 1964	Not Evaluated

Table 4.5.10-4. Architectural Properties to be Demolished within the Finegayan Cantonment/AAFB Family Housing Alternative PDIA

Building Name or Type	*Location*	*Facility Number(s)*	*Date of Construction*	*NRHP Eligible?*
Family Housing	AAFB	1000-1050, 1052, 1054-1085, 1100-1151, 1153-1187, 1200-1292, 1300-1368, 1400-1483, 1500-1571, 1700-1765, 1800-1872, 1900-1974, 2000-2062	1956 to 1963	Covered under Program Comment
Unaccompanied Personnel Housing (barracks)	AAFB	1051, 1053	1956	Covered under Program Comment
Support Facilities				
Sewer Lift Station	AAFB	1295	1960	Not Evaluated
Well AF-1	AAFB	1	Unknown	Not Evaluated
Gatehouse	AAFB	1	1964	Yes
Firehouse	AAFB	1	1955	Yes
Maintenance, support, recreation, and supply facilities	AAFB	1294, 1599, 1605, 1621, 1622, 1623, 1624, 1625, 1627, 1637, 1638, 1639, 1640, 1641, 1655, 1656, 1782, 1786, 1879, 1881, 1882, 2401, 2508, 2544, 2550, 9003, 9004, 9006, 9100, 9101, 9103, 22029, 26101	1963 to 2008	No
Pavilions/Bus Shelter	AAFB	1087, 1383, 1630, 1660*, 80140*, 80141, 80142, 80143, 81955, 81956, 81957, 81958, 81959	1987 to 1993	No
Billboards, Signs, Marquees	AAFB	1598*, 1626, 26108, 26999, 24020	2006 to 2009	No
Overwatch	AAFB	Unknown	Unknown	Not Evaluated

Legend: KW = kilowatt

Note: *Facilities that would be demolished for the Andersen Middle School expansion.

The Program Comments resolve NHPA Section 106 requirements for demolition of 784 buildings. As 65 buildings and structures are not eligible for listing in the NRHP, the demolition of these buildings under Alternative E would be consistent with a finding of no historic properties affected. Consistent with the 2011 PA, final determinations of eligibility, including the seven unevaluated properties, an assessment of effect would be completed in conjunction with project-specific reviews, if this alternative is selected.

Excavation and soil removal associated with the construction of off-site utilities and expansion of two schools could adversely affect 9 known NRHP-eligible archaeological sites (see Alternative A, Tables 4.1.10-4 and 4.1.10-5) and 1 NRHP-eligible structure. Six structures that are unevaluated could also be adversely affected by construction.

In addition, construction at Finegayan and AAFB has the potential to directly impact culturally important resources that are not historic properties, but may be considered under NEPA. The project would require the removal of limestone forest where culturally important natural resources may be present. The 2011 PA contains measures for coordinating with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans regarding identification and disposition of these important resources (see 2010 Final EIS, Volume 2: page 2-10; Volume 9, Appendix G, Chapter 4).

Operation

Operations associated with Alternative E would not directly affect any historic properties or impact other resources of cultural importance. Indirect adverse effects to known NRHP-eligible archaeological sites due to an increase in population would be minimal as these sites are not adjacent to the cantonment area.

Summary of Impacts and Potential Mitigation Measures

Implementation of Alternative E could cause direct, adverse effects to 16 known NRHP-eligible sites and 1 historic structure, which is less than Alternatives A, B, and C, but more than Alternative D. Refer to Section 4.7, Table 4.7-1 for a comparison of cultural resources impacts and potential mitigation measures for each cantonment/family housing alternative. Demolition could also affect 14 buildings and structures that have not been evaluated for listing in the NRHP (see Tables 4.5.10-3 and 4.5.10-4).

Direct impacts could occur to natural resources of cultural importance as a result of limestone forest removal. The 2011 PA includes measures to coordinate with SHPO and concurring parties to address appropriate treatment of these resources.

The 2011 PA, as discussed in Section 3.10.2., establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. Broadly, the 2011 PA includes processes to share information, consider views of the public, and develop mitigation measures when historic properties may be adversely affected. The 2011 PA provides measures for mitigating adverse effects to NRHP-eligible or listed archaeological sites, consulting on new projects and initiating additional identification efforts, and resolving impacts due to loss of access to culturally important natural resources. To the degree possible, direct and indirect impacts to historic properties and other resources of cultural importance would be avoided or minimized during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, Table 4.5.10-5 presents potential mitigation measures to resolve adverse effects to historic properties and reduce impacts to cultural resources resulting from the implementation of Alternative E. With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that significant direct and indirect impacts due to construction, as defined under NEPA, would be reduced to a level below significance.

Table 4.5.10-5. Potential Mitigation Measures for Alternative E for Adverse Effects (NHPA) and Impacts to Other Cultural Resources (NEPA)

NHPA Effects	*Mitigation*
Potential direct adverse effects to 17 historic properties - 16 NRHP-eligible archaeological sites and 1 NRHP-eligible structure)	Consistent with the 2011 PA, data recovery is the standard mitigation for historic properties that are strictly archaeological in nature. Accordingly, the DON will submit a mitigation plan to the SHPO, consult with other PA Signatories and Concurring Parties if requested, and submit data recovery reports for SHPO review prior to finalizing mitigation reports. Mitigation also includes preparation of public education and interpretation materials in English and Chamorro using the information developed or data recovered to create a summary of the work completed and a statement regarding the mitigated site's significance to the regional culture. Additional mitigation would include enforcement of construction contract stipulations and GHPI data form updates as required by the 2011 PA.
Undetermined effects to 14 unevaluated buildings	If this alternative is selected in the ROD, unevaluated properties that may be affected would be evaluated consistent with the 2011 PA. If determined eligible for listing in the NRHP, appropriate mitigation measures would be developed to resolve any adverse effects.
Potential direct impacts to culturally important natural resources	Through the 2011 PA process, coordinate with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans to provide an opportunity to collect these resources consistent with installation security instructions and safety guidelines.

4.5.11 Visual Resources

4.5.11.1 Affected Environment

A list and description of visual resources at Finegayan and AAFB is contained in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.1.1.2: Affected Environment, pages 13-9 to 13-13 and pages 13-1 to 13-8, respectively). The Finegayan area includes DON communication facilities surrounded by low grasslands, shrubs, and densely forested areas. Wide open vistas from, and into, this area are limited due to the terrain and vegetative canopy. Nevertheless, there are some areas with breaks in the canopy, providing panoramic vistas of natural and man-made features along Route 3.

AAFB is composed of runways, buildings, facilities, and housing areas all surrounded by moderately to heavily vegetated forest. Due to the relatively flat topography and moderate to heavy vegetation, the surrounding communities of Dededo and Yigo have limited views into AAFB. One exception to this is the views afforded from Mount Santa Rosa (Photos 4.3.11-1 and 4.3-11-2). From this point, sweeping 360-degree views can be seen of the entire north area, including distant views of AAFB facilities and surrounding landscape.

4.5.11.2 Environmental Consequences

Construction

Short-term direct impacts to existing public views would result from the presence of construction equipment, then would cease to continue after construction. Therefore, there would be less than significant impacts on visual resources at both the Finegayan cantonment site and the AAFB family housing site.

Operation

The operational impacts for the Finegayan cantonment under Alternative E would be less than significant, as described for Alternative A, Section 4.1.11.2. In summary, the proposed facilities would not be visible

from recognized viewpoints, vistas, or overlooks. While some features would be publicly visible from roadways, no recognized view corridors or sensitive receptors would be impacted. The new base features would be designed to be consistent with the 2011 Installation Appearance Plan so that the visible elements are consistent in design. In addition, the Haputo ERA Management Plan requires a no construction buffer zone of 100 feet (30.5 m) from the ERA boundary. There would also be an additional buffer of approximately 440 feet (134 m) from the cliffline to the Haputo Bay shoreline (total of 0.1 mile [0.2 km]).

The visual impacts related to the AAFB family housing would be as described for Alternative C, Section 4.3.11.2. In summary, the operational impacts on visual resources would be less than significant. The existing family housing area would be redeveloped at a greater density than the existing housing but the panoramic views from Mount Santa Rosa would retain the dominant presence of vegetation throughout the region.

All alternatives would have a less than significant impact on visual resources. The visual resource impacts of Alternative E would be as described for Alternatives A and C. Most of the differences in layout would be interior of the installation and not perceived from public roadways.

4.5.12 Ground Transportation

4.5.12.1 Affected Environment

The affected environment for ground transportation resources associated with Alternative E includes transportation facilities internal to the site (on-base roadways and intersections) and entry control facilities. This section addresses existing conditions and assesses how the construction and operation of Alternative E would potentially affect transportation conditions for roadways, transit facilities, and pedestrian and bicycle facilities on-base. Potential ground transportation impacts to off-base (external) roadways are addressed in Section 6.1 of this SEIS.

Roadway Network

As described in Section 4.1.12.1, Ground Transportation, for Alternative A, Finegayan is currently accessible via the existing gate located on Route 3 near Bullard Avenue. Currently, all of the on-base roadways are two lanes (one lane in each direction). Traffic counts at this military access point were conducted in December 2012. Based on the relatively low traffic demand observed at this location, the internal roadways and intersections are expected to operate at acceptable LOS (LOS A, B, C, D, or E) during the weekday a.m. and weekday p.m. peak hours.

As described in Section 4.3.12.1, Ground Transportation, for Alternative C, AAFB has two existing access gates. The Main Gate provides access between Route 1 and Arc Light Boulevard. Arc Light Boulevard is the main roadway on-base and provides an east/west route across the base. The Santa Rosa Gate is located approximately 1.1 mile (1.8 km) southeast of the Main Gate and provides access between Route 15 and Santa Rosa Boulevard. Santa Rosa Boulevard passes through housing areas on-base. All of the base roadways are two lanes (one lane in each direction), with additional separate turning lanes at major intersections. All of the on-base intersections are currently controlled by two- or all-way stop signs. The AAFB Traffic and Safety Engineering Study (AAFB 2009) concluded that most of the on-base intersections were operating at acceptable LOS (LOS A, B, C, D, or E), with the exception of several intersections along Arc Light Boulevard. The study recommended improvements for those intersections.

Transit Network

As described in Section 4.1.12.1, Ground Transportation, for Alternative A and Section 4.3.12.1, Ground Transportation for Alternative C, there is no existing transit service on Finegayan or AAFB. The GRTA operates fixed route and paratransit service. The Blueline 1, servicing Hagåtña, Tamuning, Micronesia Mall, and Tumon, is the nearest fixed route bus line, a distance of approximately 5.6 miles (9.0 km) from Finegayan and approximately 10.5 miles (16.9 km) from AAFB. Paratransit service is provided to all ADA-eligible certified passengers. Paratransit service provides transportation to the nearest fixed route.

Pedestrian and Bicycle Network

As described in Section 4.1.12.1, Ground Transportation, for Alternative A, there are no dedicated pedestrian or bicycle facilities on or near Finegayan. However, shoulders exist along Route 1 and on Route 3, south of Route 28. Typically, the outside lane or shoulder, which is generally unpaved, functions as the pedestrian/bicycle space. As described in Section 4.3.12.1, Ground Transportation, for Alternative C, there is a dedicated pedestrian jogging trail provided along Arc Light Park and Bonins Avenue. No other dedicated pedestrian or bicycle facilities exist on or near AAFB.

4.5.12.2 Environmental Consequences

Potential ground transportation impacts addressed in this section are limited to elements of the proposed action that could affect on-base (internal) roadways. Potential ground transportation impacts to off-base (external) roadways are addressed in Section 6.1 of this SEIS.

Construction

Potential short-term, direct construction impacts generated by the proposed action at Alternative E would be similar to Alternative A (Section 4.1.12.2) and Alternative C (Section 4.1.12.2). Potential impacts to ground transportation resources from construction would be reduced to less than significant levels with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, Alternative E would result in less than significant short-term, direct impacts to on-base (internal) roadways.

Operation

Roadway Network

The Alternative E Finegayan cantonment would be directly accessible from Route 3 and Route 3A. The existing gate would be closed, removed, and replaced. The cantonment area would be located at the north end of the site and would be accessible via a new Main Gate. The new Main Gate would be aligned with the westbound approach of the second roadway south of Potts Junction (i.e., the roadway immediately south of the access road to the Starts Golf Resort). At the north end of the site, a new Commercial/Tactical Vehicle Gate would be constructed on Route 3A. Within Finegayan, a four-lane arterial roadway would extend from the proposed new Main Gate to the Marine Expeditionary Brigade Headquarters. This road would be designed and expected to carry the heaviest traffic volumes, including civilian employee trips from off-base to/from work locations within the cantonment area, as well as trips by military personnel to/from the cantonment and other off-base locations.

The Alternative E AAFB family housing area would be accessed by the existing family housing gate (the Santa Rosa Gate) at the northern end of Route 15, and could also be accessed from the AAFB Main Gate off Route 9. Within AAFB, existing roadways would be utilized to the extent possible. Santa Rosa Boulevard would extend from the Santa Rosa Gate to Carolines Avenue at the north end of the family

housing area. Santa Rosa Boulevard would be upgraded and would be designed and expected to carry the heaviest traffic volumes; including civilian employee trips from off-base to/from work locations within the family housing area, as well as trips by military personnel to/from the family housing area and other off-base locations. Marianas Boulevard would provide access to residences and facilities to the east and west of Santa Rosa Boulevard. Two existing internal roadways on AAFB, Marianas Boulevard and Carolines Avenue, would connect the family housing area with AAFB.

Traffic between the Alternative E Finegayan cantonment and AAFB family housing would be off-base (external) and is addressed in Section 6.1 of this SEIS.

The proposed on-base (internal) roadway network hierarchy for Alternative E was determined based on the conceptual development plan and layout of the main cantonment and family housing area, and the capacity required to accommodate the expected travel demand on the facilities. The proposed on-base (internal) roadway network hierarchy diagram for Alternative E cantonment is included in Appendix F of this SEIS

Entry Control Facilities

Under any of the proposed cantonment/family housing alternatives, construction of new on-base (internal) roadway facilities and entry control facilities would be required. The proposed action includes construction of on-base (internal) roadways and entry control facilities that would be implemented by the DoD. On-base (internal) roadways and entry control facilities for Alternative E, include, but are not limited to, the following:

- The existing gate would be closed and a new Finegayan Main Gate would be constructed. The new Finegayan Main Gate would form the fourth leg (eastbound approach) of the existing Route 3/Chalan Kareta intersection.
- A new Commercial/Tactical Vehicle Gate (unattended) would be constructed at the north end of the cantonment on Route 3A.
- The existing AAFB Main Gate on Route 9, and the existing Santa Rosa Gate on Route 15, would provide direct access to the family housing area. The AAFB Santa Rosa Gate would be improved as part of the proposed action.

All on-base (internal) roadway segments and intersections have been designed with the capacity required to accommodate the expected travel demand. Specifically, on-base (internal) roadway segments and intersections are designed to operate at acceptable LOS (LOS A, B, C, D, or E) under future year (Year 2030) conditions with the proposed action. Alternative E would not result in significant long-term, direct impact to on-base (internal) roadways or intersections, because Alternative E would not:

- For roadway segments and intersections - cause a roadway segment or intersection operating at acceptable LOS (LOS A, B, C, D, or E) to degrade to unacceptable LOS F.
- For roadway segments - add 5% or more to the total directional peak hour volume (measured in passenger car equivalents) and result in unacceptable LOS F.
- For intersections - add 50 or more peak hour trips (measured in passenger car equivalents) and result in unacceptable LOS F.

Transit Conditions

Implementation of Alternative E would not result in significant long-term, direct impact to transit, because Alternative E would not:

- Substantially increase traffic hazards to transit due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with applicable design standards.
- Fundamentally conflict with adopted policies, plans, or programs regarding public transit, or otherwise decrease the performance or safety of transit facilities.

Pedestrian and Bicycle Conditions

Bicycle and pedestrian facilities would be included in the construction of new on-base (internal) roadway facilities. Bicycle and pedestrian paths and facilities are integrated into the on-base transportation network as a means to improve mobility and safety of non-motorized traffic. The proposed bicycle and pedestrian network diagram for Alternative E is provided in Appendix F of this SEIS.

The proposed bicycle and pedestrian network at Finegayan includes an extensive multi-purpose trail network along most major roadways that would provide access to most facilities within the cantonment. Additionally, a jogging/biking trail would circumnavigate the periphery of the cantonment. The proposed bicycle and pedestrian network at AAFB includes a multi-purpose trail along the main corridor of the family housing area. Additionally, all residential streets would be constructed with sidewalks on both sides and a jogging/biking trail would circumnavigate the periphery of the family housing area.

Implementation of Alternative E would not result in significant long-term, direct impact to pedestrians or bicycles because Alternative E would not:

- Substantially increase traffic hazards to pedestrians or bicycles due to a design feature (e.g., sharp curves or dangerous intersections) that does not comply with applicable design standards.
- Fundamentally conflict with adopted policies, plans, or programs regarding bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

4.5.13 Marine Transportation

4.5.13.1 Affected Environment

The level of use of marine transportation facilities is predicted to be the same regardless of the selected alternative. Therefore, the affected environment for marine transportation under Alternative E is the same as described in Section 3.1.13.1 for Alternative A.

4.5.13.2 Environmental Consequences

The environmental consequences for marine transportation under Alternative E would be the same as described in Section 4.1.13.2 for Alternative A. Short-term and long-term impacts would be less than significant.

4.5.14 Utilities

4.5.14.1 Affected Environment

Electrical Power

Electrical distribution for the cantonment of Alternative E at Finegayan is the same as Alternative A. This includes the existing federally owned power distribution system solely for critical Naval Computer and Telecommunications Station operations. The general power being supplied to this area comes from the

GPA generation system via a 34.5 kV transmission line (owned by the DoD and leased to the GPA). The situation and condition of these utility systems is unchanged from the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.1: Affected Environment, pages 3-5).

There is existing power infrastructure for the existing Family Housing at AAFB. The electrical power is provided by GPA 34.5 kV transmission lines along Routes 3, 9, and 1 that feed the recently replaced main substation at AAFB.

Potable Water

The affected environment for the potable water utility under Alternative E is the same as under Alternatives A and C.

Wastewater

The GWA compliance background presented in Section 4.1.14.1 for Alternative A is the same for Alternative E.

The affected environment for the cantonment at Finegayan in Alternative E is the same as Alternative A. The affected environment for the family housing in Alternative E is the same as Alternative C. Both existing DoD wastewater collection systems at Finegayan and AAFB convey flow to a GWA interceptor sewer along Route 9 and Route 3 to the Northern District WWTP for treatment and disposal.

Solid Waste

The affected environment for the cantonment at Finegayan in Alternative E is the same as Alternative A. The affected environment for the family housing in Alternative E is the same as Alternative C.

Information Technology and Communications

The existing IT/COMM utility for the cantonment at Finegayan in Alternative E is the same as Alternative A. The existing IT/COMM utility includes existing DoD and commercial telecommunication duct banks, manholes/handholes, and connection buildings. The existing DoD IT/COMM infrastructure has extensive high bandwidth fiber optic distribution systems present throughout the Finegayan site. This infrastructure includes a system of duct banks and manholes/handholes that feed from existing Building 112 on Finegayan where the existing telecommunication node is located.

Existing commercial phone and television services at Finegayan are provided through a combination of overhead and underground distribution lines from local service providers. Telephone services at the Finegayan site are currently provided by GTA TeleGuam via the existing Astumbo telephone switching station along Route 3. Television services at Finegayan are currently provided by MCV from an overhead distribution line along Route 3. The existing IT/COMM at the family housing area at AAFB in Alternative E is the same as Alternative C and includes existing and underground DoD and commercial communication lines.

4.5.14.2 Environmental Consequences

Electrical Power

The environmental consequences of Alternative E are the same as Alternative A. The reduction in the projected load as a result of moving the housing load to AAFB does not impact the environmental consequences as discussed in Alternative A. Also the existing AAFB main substation has adequate capacity to support the proposed new housing at AAFB.

Therefore, the environmental impact to the electrical power resource for Alternative E is less than significant for both construction and operations at both the cantonment and family housing areas.

Potable Water

The existing DoD water system at Finegayan does not have the additional capacity to handle the increased demand from the cantonment portion of the proposed action. The proposed potable water distribution system for the Marine Corps cantonment under Alternative E has been developed to handle the system demands of the proposed action. The current water system serving existing facilities would remain in service, with interconnections to the proposed water system to provide for redundancy and operational efficiency. There are seven active water production wells currently producing water on Finegayan and one operational well on standby being used as an aquifer monitoring well. There are also some GWA water production wells in the area along Route 3. Continued use of some of these wells would need to be negotiated with the GEPA due to the proximity of proposed cantonment facilities that are within the wellhead protection zone and could cause groundwater contamination. Through the use of best management practices and protective design features, it appears that it may be feasible to keep the DON Finegayan wells in service. Initial discussions regarding this approach have been held with GEPA on May 16, 2014. Agreement in principle on this approach has been obtained. All construction and operation activities within the wellhead protection zone of DoD wells would be done in accordance with GEPA regulations, as described above.

There would be no significant direct, short-term impact to current DoD water customers as the proposed system would supplement any lost water production. During construction, the proposed system would have excess capacity until the Marine Corps fully occupies the proposed cantonment installation. It should also be noted that the water production from the existing Finegayan wells is used to meet demands from both existing facilities and operations at Finegayan, Barrigada and other DON users as needed. It is also anticipated that the proposed water supply wells at AAFB would be installed during the early phases of construction. The short- and long-term direct impact to the Finegayan DoD potable water system from Alternative E is therefore considered less than significant during both construction and final operational conditions.

At AAFB there is an existing potable water distribution system serving the area proposed for family housing that would need to be restructured during the redevelopment proposed under Alternative E. As part of the DoD water system improvements to support the proposed action, approximately 11 new water supply wells are proposed to be installed at AAFB. This new water supply system would also be tied into the existing AAFB water system. The proposed potable water distribution system for Alternative E has been developed to handle all system demands currently in existence for areas served by the current DoD water distribution system, in addition to the increased demand from the family housing portion of the proposed action. During construction, service would be maintained to current DoD customers via construction phasing, temporary lines, or other actions. Thus, there would be no adverse impacts for the current DoD water customers aside from potentially brief water outages during construction of the expanded and modified systems. With careful planning, these potential outages would be minimized.

DoD Potable Water System

The short- and long-term direct impacts to the DoD potable water system with the implementation of Alternative E would be the same as under Alternative A, as described in Section 4.1.14.2. These impacts would be less than significant during both construction and during final operational conditions because the improvements would provide adequate potable water to meet current needs, and the proposed Marine Corps facilities would be in compliance with regulatory requirements.

GWA Potable Water System

Potential impacts to the GWA system would be the same for Alternative E as for Alternative A, as described in Section 4.1.14.2. Thus, the short- and long-term impact to the GWA's distribution system from the proposed action is expected to be less than significant due to the small increase in demand from the indirect impacts of the proposed action.

NGLA Water Extraction

Potential short- and long-term impacts to the NGLA and proposed mitigation measures for impacts would be the same for Alternative E as for Alternative A, as described in Section 4.1.14.2. Thus, the localized direct impact to the NGLA is considered significant, but the impact to the overall NGLA is less than significant.

Wastewater

The proposed wastewater infrastructure for Alternative E, as described in Section 2.4.4.5, has been developed to meet the needs of the proposed action. As described below, the potential impacts and mitigations for wastewater utilities for Alternative E would be the same as for Alternative A.

In 2010, the DON conducted a sewer capacity study (DON 2010) using a hydraulic model developed for the GWA WRMP that was modified and calibrated with 2010 flow monitoring data. Based on the flow scenario in the sewer capacity study (which was similar to the 2010 Final EIS proposed action estimated flows), the GWA interceptor sewer along Route 3 and Route 9 can adequately convey dry- and wet-weather flows. The GWA interceptor sewer ranges in size from 30 inches (76 cm) to 42 inches (107 cm) in diameter along Routes 3 and 9. There is one segment of each sewer size where the maximum flow depth could be three quarters of the pipe diameter at peak flows. Updated sewer collection system model runs were completed and the results show that the existing sewers have adequate capacity to handle the projected flow in year 2028. However, in late 2014 the DON obtained closed circuit television footage from GWA of the main sewer lines from AAFB to the Northern District WWTP, mostly routed along Routes 3 and 9. Based on available information from closed-circuit television footage of the Northern District WWTP collection system, the concrete reinforced pipe sewer line from AAFB to the Northern District WWTP along Routes 3 and 9 is in a state of deteriorated condition that requires rehabilitation or replacement. Therefore, this operations impact is significant but mitigable.

GovGuam received funding from USEPA to conduct the sewer system evaluation survey in northern Guam. GWA awarded a sewer system evaluation survey of the northern collection system in late 2014, but those results were not available at the time of publication of the Final SEIS.

The Northern District WWTP currently treats wastewater to primary treatment standards. The 2013 NPDES permit for the plant requires discharge to meet secondary treatment standards and Guam Water Quality Standards, including those for nutrients. The Northern District WWTP requires treatment system upgrades to meet the NPDES permit standards. Until the required upgrades are operational, additional projected wastewater flows from the proposed action and all other sources would be treated to primary treatment standards. Increasing the wastewater flow to a non-compliant treatment plant would be a significant direct impact during the period of non-compliance with the permit. Because some of the proposed construction would occur during this period of non-compliance, there would be direct and unmitigable significant impacts to the wastewater system until the Northern District WWTP upgrades are completed.

Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate significant impacts to the wastewater system on Guam. The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. The water and wastewater assessment that DoD prepared to support the implementation plan recommends upgrades to the Northern District WWTP and refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended. The indirect impacts to the Agaña WWTP from Alternative E are the same as from Alternative A, as described in Section 4.1.14.2. Under Alternative E, the increased wastewater flows from the proposed action would be considered negligible (less than 1% of the total projected flow [see Table 4.1.14-2]). Therefore, consistent with impact assessment criteria in the SEIS, the impact from the proposed action to Agaña WWTP would be less than significant.

The indirect impacts to the central wastewater collection system conveying flow to the Agaña WWTP are deemed less than significant due to the negligible increase in flow from the proposed action for both construction and operations.

The indirect impacts to GWA's southern WWTPs and collection systems from Alternative E are the same as from Alternative A, as described in Section 4.1.14.2. With the negligible flows anticipated to these southern wastewater systems and the planned capital improvements projects, the indirect impacts of the proposed action would be less than significant, for both construction and operations.

Mitigation measures for significant impacts in Alternative E would be the same as in Alternative A as described in Section 4.1.14.2.

Solid Waste

The environmental consequences for the solid waste infrastructure associated with the cantonment at Finegayan are similar to Alternative A. The differences with Alternative A are that the family housing area would be located at AAFB and not Finegayan and would also require increased C&D waste generation from the additional housing units being demolished and constructed. The handling of this additional C&D waste would be the same as for Alternative A. The family housing area located at AAFB would be served by the existing local solid waste infrastructure at AAFB that currently services the existing family housing area. The impacts to the existing solid waste infrastructure would be an approximate 11% increase to the solid waste generation based on the increased number of housing units planned for the AAFB family housing area. The environmental consequences to the solid waste infrastructure serving the AAFB family housing area would be the same as described for Alternative C.

Therefore, the potential long-term direct impact on the Guam solid waste infrastructure support systems for Alternative E would be less than significant.

Information Technology and Communications

As in Alternative A, the current DoD IT/COMM infrastructure for the cantonment at Finegayan in Alternative E would remain in place during and after the proposed new facilities are constructed and in operation. Any existing lines for areas that would be under new roads, parking lots, or other areas subject to loads at ground surface would have to be encased in concrete, and several existing communication

lines would require rerouting. During this rerouting construction, close coordination with Naval Computer and Telecommunications Station operations would be required to ensure any critical communication lines impacted would be kept in operation via alternate signal routing. Existing Building 112 currently has adequate connection capacity to handle additional IT/COMM connectivity that would be required by the proposed alternative at Finegayan, but additional distribution of conduit and lines would need to be installed to properly interconnect the DoD communications requirements. New duct banks required for Alternative A as described in Chapter 2 of this SEIS include a duct bank of up to twelve 4-inch (10-cm) conduits looped between the main IT/COMM distribution facilities, as well as a system of duct banks and various conduits distributed in and around the site connecting the main distribution facilities to each building or end user. Various cables types would be required within this system of conduits, including 144 and 288 strand fiber optic cables, copper cables with 600 pair telephone lines, and smaller cables to individual buildings.

Additional inter-base IT/COMM connectivity would be required as described in Chapter 2. This includes the connection between AAFB and the existing Tata cable landing facility in southern Guam, which would require new rights of way along some southern roads and the access road to the Tata facility.

Current DoD IT/COMM underground communication lines within the family housing area at AAFB would remain in place during and after the proposed new facilities are constructed and in operation. Any existing lines for areas that would be under new roads, parking lots, or other areas subject to loads at ground surface would have to be encased in concrete, and several existing communication lines would require rerouting. During this rerouting construction, close coordination with the Department of the Air Force operations would be required to ensure any critical communication lines impacted would be kept in operation via alternate signal routing.

The current commercial IT/COMM facilities have adequate capacity within nearby infrastructure at Finegayan for the cantonment and at AAFB for the family housing. The existing commercial cables within the proposed remodeled family housing area at AAFB could be rerouted or demolished as required. New duct banks would be required to provide commercial service to the proposed cantonment area at Finegayan and the family housing at AAFB. There could be short-term lack of commercial service during the construction phase, but no permanent or long-term environmental consequences to the commercial IT/COMM infrastructure. The direct impact to IT/COMM is deemed less than significant both during construction and in operation.

4.5.15 Socioeconomics and General Services

4.5.15.1 Affected Environment

The affected environment for socioeconomics and general services on Guam is presented for the entire island of Guam and does not vary by alternative. Because the affected environment does not vary by alternative, it is only presented one time, under Alternative A. A full description of the affected environment for socioeconomic and general services is presented in Section 4.1.15.

4.5.15.2 Environmental Consequences

The socioeconomics and general services impacts under Alternative E would be island-wide, direct and indirect, short- and long-term, and would be the same as described under Alternative A in Section 4.1.15. The population change associated with Alternative E would not likely put excessive strain on Guam's public services and permitting agencies, and the estimated increases in GovGuam tax revenues would likely compensate for any increased demand that would occur. The economic impacts would be beneficial, leading to increased employment and standards of living, and impacts to Guam's housing

stock and availability would not bring about reactionary development, which could have otherwise lead to dislocations in the housing market. There is a potential for sociocultural impacts to occur, but the magnitude of the impacts could vary substantially based on policy and program choices yet to be made on how to address them.

4.5.16 Hazardous Materials and Waste

4.5.16.1 Affected Environment

Under Alternative E, the affected environment for hazardous materials and waste is as described for Alternative A (Section 4.1.16.1) and Alternative C (Section 4.3.16.1). The affected environment for hazardous materials and waste management is summarized briefly below under the following two subheadings: Finegayan (cantonment), and AAFB (housing).

Finegayan (Cantonment)

NAVFAC is responsible for overseeing the management of hazardous materials on all DON facilities on Guam. Hazardous materials at Naval Base Guam are stored at a warehouse operated by Joint Environmental Material Management Service. Joint Environmental Material Management Service consolidates hazardous materials for reuse and tracks it through an inventory management program. Unused hazardous materials are returned to Joint Environmental Material Management Service for redistribution or disposal.

Operations at DoD installations on Guam generate a variety of hazardous waste, including, but not limited to waste of: medical and dental supplies, adhesives, solvents, contaminated absorbents, corrosive liquids, aerosols, pesticides, used POLs, and sludges. In accordance with DoD policies, all facilities must seek to reduce or eliminate hazardous waste generation by implementing BMPs, SOPs, and best available technologies. DRMO maintains all hazardous waste documentation and ensures that all disposal actions are performed in accordance with pertinent federal, state, and local laws and regulations.

There are two IRP sites located on Finegayan; however, these sites are not located within the proposed footprint of the main cantonment. The sites are summarized in Table 4.1.16-1 and depicted in Figure 4.1.16-1.

AAFB (Housing)

Hazardous materials at AAFB are managed by the installation's Hazardous Materials Pharmacy, under the Logistics Readiness Squadron. The Air Force has requirements for readily accessible fuel and related storage facilities on Guam. Numerous fueling operations to support aircraft, vehicle operation, and emergency power generation are performed at AAFB. The majority of fuel is aviation fuel.

DRMO arranges for all hazardous waste collection, transportation, and disposal via licensed contractors who ultimately dispose of the hazardous waste at permitted off-island disposal facilities (AAFB 2007).

There are six IRP and potentially contaminated sites located in the AAFB ROI (see Table 4.3.16-1), however, only 1 is located within the proposed family housing foot print. The remaining sites are at such a distance from the proposed family housing footprint that they are unlikely to affect site conditions. Additionally, the majority of the sites have been remediated or determined to not present a risk to human health or ecological receptors. Those sites that are currently active or have land use restrictions are depicted in Figure 4.3.16-1.

4.5.16.2 Environmental Consequences

Short-term construction impacts and long-term operational impacts to hazardous materials and waste under Alternative E would be similar to those described under Alternative A (Section 4.1.16.2) and Alternative C (Section 4.3.16.2) of this SEIS.

In summary, adherence to applicable BMPs and SOPs during construction and operations would reduce the likelihood and volume of accidental releases, allow for accelerated spill response times and enable timely implementation of cleanup measures, thereby minimizing potential impacts to the environment. Construction and demolition activities associated with this alternative would have no long-term direct or indirect impact on the management of hazardous materials at DoD facilities on Guam. Hazardous materials would continue to be managed under established hazardous material SOPs. Indirect Long-term beneficial impacts would occur to fuel storage and conveyance infrastructure as it would need to be brought into compliance before planned increases in capacity could be implemented.

The overall reduction in long-term increased use of hazardous materials from operations under the SEIS alternatives, as compared to the 2010 Final EIS, would be dependent on a variety of factors and cannot be quantified based on available information. Although reduced relative to the 2010 Final EIS volumes of hazardous materials, operations under Alternative E would still represent a substantial long-term increase in the volumes of hazardous materials relative to baseline conditions.

Should suspected environmental contamination be encountered during construction or operational activities, work would stop and the appropriate authorities would be notified. If appropriate, soil and groundwater samples would be collected to determine the nature and the extent of the contamination and whether remedial action would be required.

Under Alternative E, direct or indirect impacts to contaminated sites from construction or operations would be less than significant. Any potentially contaminated sites would be assessed and remediated, as appropriate, for the proposed reuse of the site. Construction or operational activities would not disturb any remediation sites or controls or interfere with monitoring areas, if present.

Should there be a need to import off-island earthen materials, all GEPA, Department of Agriculture, and local rules and regulations would be followed.

Therefore, implementation of Alternative E would result in less than significant direct and indirect impacts to hazardous materials and waste.

4.5.17 Public Health and Safety

4.5.17.1 Affected Environment

Under Alternative E, the affected environment for public health and safety is as described for Alternative A and Alternative C in Section 4.1.17.1 and Section 4.3.17.1, respectively. In addition, an extensive discussion of the affected environment for public health and safety matters on Guam is provided in the 2010 Final EIS (Volume 2, Chapter 18: Public Health and Safety, Section 18.1: Affected Environment, pages 18-1 to 18-12).

In summary, to protect the general public from intentional or accidental entry onto Finegayan or AAFB, locked or manned gates are used where vehicle access is provided and a series of signs warning unauthorized personnel not to enter the area are posted along the perimeter of the installation. Unauthorized personnel are not allowed on the installation at any time.

Activities on existing small arms range at both Finegayan and AAFB are conducted in accordance with SOPs to ensure the safety of both range participants as well as the public. While these existing small arms ranges are not part of the proposed action, they would remain active at both locations. Additionally, the areas proposed for housing at AAFB under Alternative E are situated outside of the APZs. Off-base lands within the APZ were addressed in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.1.2.1: Andersen AFB, page 8-24).

Aircraft take-off/departure from AAFB flies over Finegayan, generating noise in the range of 60-65 dBA. Current noise levels are within the acceptable range for cantonment/residential facilities. At AAFB, the areas proposed for housing that are south of the airfield are situated within the 60-70 dB noise contours. Areas north and west of the airfield are within the 65-80 dB noise contours (see Figure 4.1.4-1). Details regarding current noise conditions at AAFB are provided in Section 4.3.4.1.

4.5.17.2 Environmental Consequences

Potential direct and indirect impacts on public health and safety from implementation of Alternative E would be similar to those discussed under Alternative A (Section 4.1.17.2) and Alternative C (Section 4.3.17.2).

Notifiable Diseases

Potential increases in notifiable diseases for Alternative E would be the same as discussed in Section 4.1.17.2 for Alternative A.

Mental Illness

Potential increases in mental illness for Alternative E would be the same as discussed in Section 4.1.17.2 for Alternative A.

Operational Safety

To protect the general public from intentional or accidental entry onto Finegayan and AAFB, locked or manned gates would continue to be used where vehicle access is provided and a series of signs warning unauthorized personnel not to enter the area would remain posted along the perimeter of the installation. Unauthorized personnel would not be allowed on the installation at any time.

The areas proposed for housing at AAFB are situated outside of the APZs. Specific and documented procedures would be in place to ensure the public is not endangered by operations and training activities. Therefore, Alternative E would result in no direct or indirect impacts on public health and safety (resulting from operations and training activities).

Construction and infrastructure improvements related to the proposed military relocation to Finegayan and AAFB would be consistent with established ESQD areas on the installations. SOPs would ensure the safe transportation of munitions, and incident response procedures are in place in the event of a munitions transport incident.

In addition, no direct or indirect impact on public health and safety related to electromagnetic emissions is anticipated.

Because a health and safety program would be implemented for construction activities and the public would be excluded from entering construction areas, potential short-term construction impacts on public health and safety would not result in any greater safety risk.

Therefore, no significant impacts associated with operational safety would occur.

Environmental Health Effects

Potential short-term construction and long-term operational noise emissions associated with Alternative E would be similar to those discussed under Alternative A and Alternative C. Enforcement of OSHA guidelines for hearing protection for workers would be the responsibility of the construction contractor. The public would be excluded from entering construction areas. Therefore, short-term construction noise impacts on public health and safety would be less than significant. Long-term operational noise from activities occurring on Finegayan and AAFB would be similar to current noise levels. The area proposed for housing that is south of the airfield is situated within the 60 to 70 dB noise range and is compatible with residential development. Areas north and west of the airfield are within the 65 to 80 dB noise range. These areas would mostly be incompatible for residential development but would allow for operations activities. Construction of buildings in these areas should implement noise level reduction measures to reduce interior noise levels to allow normal conversation. Existing aircraft noise is not at a level that would result in the loss of hearing of housing area occupants. Therefore, the overall direct or indirect impacts associated with noise to human health and safety would be less than significant.

Potential water quality impacts associated with Alternative E would be similar to those discussed under Alternative A and Alternative C. Groundwater withdrawal would likely increase. However, sustainability practices would be implemented to reduce the amount of groundwater needed. Proposed development and operational activities would be conducted in accordance with GEPA guidance and BMPs to minimize the potential for contaminants to be introduced in these areas. Therefore, direct and indirect public health and safety impacts from long-term increased demand on potable water and potential water-related illnesses would be less than significant.

Hazardous Substances

Potential direct impacts from hazardous substances for Alternative E would be similar to those discussed under Alternative A and Alternative C. The use, handling, storage, transportation, and disposition of hazardous substances would be conducted in accordance with applicable hazardous material and waste regulations, and established BMPs and SOPs to ensure that the health and safety of workers and the general public is maintained.

IRP investigations and/or remediation activities, as necessary, would continue in an effort to clean up past releases of hazardous substances and receive regulator concurrence that necessary actions have been completed to ensure the safety of the public. No off-site population is near the IRP sites. Building construction is not proposed within the footprint of IRP sites. Based on investigations of the contaminants associated with sites on Finegayan and AAFB (within proposed cantonment and housing development areas), no health hazards have been identified. Because hazardous substance management and IRP investigative/cleanup activities would be conducted in accordance with applicable regulations and established BMPs and SOPs, no direct or indirect impacts on public health and safety are anticipated.

Unexploded Ordnance

Potential direct impacts from UXO under Alternative E would be similar to those discussed under Alternative A and Alternative C. The general public would be excluded from entering construction zones and training areas. BMPs would be implemented to identify and remove potential MEC items prior to the initiation of ground-disturbing activities. UXO personnel supervision would occur during earth-moving activities and MEC awareness training would be provided to construction personnel involved in grading and excavations prior to and during ground-disturbing activities. Because UXO would be identified and removed prior to initiating construction activities and construction personnel would be trained as to the

hazards associated with UXO, potential direct impacts from encounters with UXO would be minimized and less than significant.

Traffic Incidents

As a result of the long-term increase in military personnel and their dependents, there would be more vehicles on the roadways potentially resulting in more heavily congested roadways and, thus, more potential for accidents and traffic fatalities. As illustrated in Table 4.1.17-4, the annual number of traffic accidents could increase. Although implementing Alternative E could mean more military personnel on the roads, the actual potential for increased traffic incidents is small (5% increase/358 traffic incidents annually). Because no high crash frequency intersections are located near Finegayan or AAFB and the overall long-term potential increase in the number of traffic accidents as a result of the increase in personnel would be minimal, there would be a less than significant impact on the health and safety of the citizens of Guam (from traffic incidents).

4.5.18 Environmental Justice and the Protection of Children

4.5.18.1 Affected Environment

As described in Alternative A, the affected environment for environmental justice and the protection of children analysis is the entire island of Guam. Therefore, the affected environment for Alternative E is the same as for Alternative A. In addition, both Alternative E locations are in the northern area of the island, the same region as Alternative A. The villages of Dededo and Yigo are within this region.

4.5.18.2 Environmental Consequences

Potential impacts to environmental justice populations under Alternative E would be to noise, recreation, socioeconomic and general services (including health services), and public health and safety.

Noise

The potential impacts would be the same as Alternative A.

Recreation

Impacts are generally island-wide and would be the same as described for Alternative A.

Socioeconomics and General Services

Impacts are generally island-wide and would be the same as described for Alternative A, as would the identified measures to mitigate impacts.

Public Health and Safety

Impacts are generally island-wide and would be the same as described for Alternative A, as would the identified measures to mitigate impacts.

4.6 NO-ACTION ALTERNATIVE FOR CANTONMENT/HOUSING

Under the No-Action Alternative for this SEIS, the DON would continue to implement the September 2010 ROD, including construction and operation of a cantonment area for approximately 8,600 Marines and approximately 9,000 dependents on DoD-controlled lands at Finegayan and South Finegayan and by acquiring land known as the former FAA parcel.

4.6.1 Geological and Soil Resources

For the No-Action Alternative, the impacts to geological and soil resources would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.2.3, page 3-49). Under the No-Action Alternative, there would be adverse, but less than significant, direct long-term impacts to topography due to permanent alteration of the landscape. The construction footprint for the No-Action Alternative would be 78% larger than the footprint for Alternative A and would involve a proportionately larger amount of excavation than Alternative A. Approximately 62 features have been preliminarily identified as sinkholes or depressions that may contain sinkholes within or on the perimeter of the No-Action Alternative footprint but there would be less than significant direct, short- and long-term impacts to sinkholes with implementation of sinkhole protection measures. By comparison, 43 similar features have been identified for Alternative A (the most for any of the action alternatives) which would also have less than significant direct, short- and long-term impacts to sinkholes with implementation of sinkhole protection measures.

4.6.2 Water Resources

For the No-Action Alternative, impacts to water resources would be generally as described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.3: Alternative 2 (Preferred Alternative), pages 4-118 to 4-123), except as updated below with new information or analysis.

No buildings/structures would be constructed in the 100-year or 500-year flood zones and no surface waters are located within or near the proposed construction areas under the No-Action Alternative. Given compliance with the Construction General Permit and BMPs, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely. Therefore, construction activities associated with the No-Action Alternative would result in no impacts to surface waters.

While it is expected that the GWA could meet the increased potable water demand during construction and that there would only be a minimal increase in pumping from the NGLA due to construction, the number of spills from GWA's sewage collection system continues to greatly exceed spill rate norms for similar wastewater systems. Increased wastewater flows associated with the additional construction/DoD workforce would potentially increase the rate of sewage spills, potentially resulting in significant indirect impacts to groundwater quality during construction.

The No-Action Alternative would add substantially more impervious surface area to Guam (883 acres [357 ha]), as compared to the action alternatives discussed in Chapter 4, with Alternative D having the greatest increase in impervious area (319 acres [129 ha]) of the five action alternatives.

After construction, the large increase in island-wide demand on the existing Guam sewer collection systems, due to the large amount of induced growth projected (as compared to the five SEIS action alternatives), would result in significant adverse indirect impacts from increased potential for sewage spills anywhere on the central sewer collection system. Such spills could affect all categories of water resources (e.g., surface waters, groundwater, nearshore waters) anywhere on Guam. These impacts would

be mitigated by improvements and upgrades to the Guam wastewater system and expansion/ rehabilitation of the NGLA monitoring well network, as described for the wastewater impacts of the SEIS action alternatives (see Section 4.1.2.2).

The No-Action Alternative and the five action alternatives would have similar short-term significant direct impacts to nearshore waters. Upgrades of the Agaña WWTP and Northern District WWTP treatment systems in the long-term would be beneficial to the water quality of nearshore waters. However, until the WWTP upgrades were completed there would be an indirect and unmitigable significant impact to nearshore waters during construction and operation. The No-Action Alternative would have no direct impacts on wetlands similar to Alternatives A, B, C, and E.

Under the No-Action Alternative the estimated daily average groundwater withdrawals from the NGLA to meet potable water demand would be 5.8 MGd (22.0 MLd), as compared to 1.7 MGd (6.4 MLd) for the five action alternatives in this SEIS. The 2010 Final EIS concluded that groundwater withdrawals from the NGLA would result in less than significant impacts. However, results from the new USGS study, which was completed in 2013 (USGS 2013c), indicate that the five action alternatives would result in localized significant impacts to the NGLA, and less than significant impacts to the overall NGLA. Therefore, it is assumed that the significantly larger groundwater withdrawals under the No-Action Alternative would have similar, but greater localized significant impacts to the NGLA that would be mitigated as described for the action alternatives.

4.6.3 Air Quality

For the No-Action Alternative, air quality impacts would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.2.3: Preferred Alternative (Alternative 2), pages 5-27 to 5-29 and 5-35 and Volume 6, Chapter 7: pages 7-37 to 7-46 and 7-72). Air quality impacts under the No-Action Alternative and the action alternatives discussed in Chapter 4 would be less than significant. However, impacts under the No-Action Alternative would be slightly greater than the action alternatives, given the greater scale of construction and operational activities.

4.6.4 Noise

Under the No-Action Alternative, noise impacts would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 6: Noise, Section 6.2.3: Preferred Alternative (Alternative 2), pages 6-21 to 6-59 and Volume 6, Chapter 8: Noise, Section 8.2: Environmental Consequences, pages 8-11 to 8-50). Noise impacts under the No-Action Alternative would be less than significant or significant but mitigable, depending on the location of construction activities. By comparison, the construction period for the action alternatives discussed in Chapter 4 would be extended, which would allow for the construction schedule to sequence work tasks and only one or two pieces of heavy equipment to operate in areas close to the nearest receptors, resulting in a reduction of noise impacts. As a result, all of the action alternatives would result in less than significant noise impacts with the implementation of BMPs.

4.6.5 Airspace

For the No-Action Alternative, impacts to airspace would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 7: Airspace, Section 7.2.3: Alternative 2 (Preferred Alternative), page 7-15). There would be no impacts to airspace for both the No-Action Alternative and action alternatives discussed in Chapter 4.

4.6.6 Land and Submerged Land Use

For the No-Action Alternative, impacts to land and submerged land use would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.2.4: Alternative 2 (Preferred Alternative), pages 8-75 to 8-76). The No-Action Alternative would be developed on federally owned land (Finegayan and South Finegayan) but would also require land acquisition of the former FAA parcel (680 acres [275 ha]). By comparison, the action alternatives discussed in Chapter 4 would not require land acquisition. Significant but mitigable impacts to land use under the No-Action Alternative would result from the new public access restrictions to the Latte Stone Park at South Finegayan. To mitigate this impact to a less than significant level, the DoD would work with the community to provide access to Latte Stone Park to the extent practicable. Similar significant impacts under the proposed action (2012 Roadmap Adjustments) would only occur under Alternative B due to similar public access restrictions to the Latte Stone Park. Additional significant public access impacts would occur under the No-Action Alternative due to loss of public access to the jogging trail at the former FAA parcel but this impact would be unmitigable.

4.6.7 Recreational Resources

For the No-Action Alternative, impacts to recreational resources would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 9: Recreational Resources, Section 9.2.3: Alternative 2 (Preferred Alternative), pages 9-27 to 9-29). There would be significant impacts to recreational resources (i.e., increased user demand, accelerated deterioration, diminished user satisfaction due to reduced recreational opportunities, and conflicts between users and uses) under the No-Action Alternative, while there would be would less than significant impacts to recreational resources under the action alternatives discussed in Chapter 4 due to the substantially smaller number of Marines and dependents that would arrive on Guam.

4.6.8 Terrestrial Biological Resources

Table 4.6.8-1 provides a brief summary of terrestrial biological resource impacts that would result with implementation of the No-Action Alternative as described in the 2010 ROD and as the preferred alternative in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.3: Alternative 2, pages 10-169 to 10-177).

Table 4.6.8-1. Potential Impacts from the Proposed Cantonment/Family Housing Area under the No-Action Alternative

Impact Component	*Vegetation*	*Special Management Areas*	*Wildlife*	*SS Species (significant impacts only)*
Cantonment/Family Housing at Finegayan, South Finegayan, and the Former FAA Parcel				
Construction	Direct - SI	Direct - SI (Loss of 1,106 acres (448 ha) of Overlay Refuge)	Direct - LSI Indirect - LSI	**ESA-Listed Fruit Bat:** Direct - SI-M (loss of habitat) Indirect - SI-M (invasive species) **All other SS species currently present:** Indirect - SI-M (invasive species)
Operation	Indirect - LSI	Indirect - LSI	Direct - LSI Indirect - LSI	**ESA-Listed Fruit Bat:** Direct - SI-M (loss of habitat) Indirect - SI-M (invasive species) **All other SS species currently present:** Indirect - SI-M (invasive species)

Legend: LSI = less than significant impact, SI = significant impact, and SI-M = significant impact that is mitigable.

Of the approximate 21,690 acres (8,778 ha) of Overlay Refuge, 1,106 acres (448 ha) would be removed with construction of the cantonment area as proposed under the preferred alternative in the 2010 ROD. This area represents 5.1% of Overlay Refuge lands on Guam. Overlay Refuge lands contain habitat that would be suitable for recovery efforts of special-status species, including those that do not presently occur within the action area.

The 2010 Final EIS concluded that implementation of the preferred alternative would result in significant impacts to the Mariana crow and Guam Micronesian kingfisher. However, the Mariana crow is now considered extirpated from Guam (Personal communication via letter from USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, HI regarding the DON NOI for Proposed Placement of LFTRC on Guam NWR, December 7, 2012). As both the crow and the kingfisher are extirpated from Guam, there would be no impacts to these species from the construction and operation of the proposed cantonment/family housing complex under the No-Action Alternative.

There would be a direct, significant impact on the Mariana fruit bat due to the removal of 816 acres (330 ha) of suitable habitat during construction and indirectly due to disturbance of habitat adjacent to the proposed facilities. This would be mitigated with the conservation actions proposed in the 2010 Final EIS to less than significant.

Indirectly, movement of construction personnel, equipment, and supplies could result in the spread of invasive plant and animal species to Guam, within Guam, or to other locations from Guam. Invasive species could affect special-status species or degrade habitat and therefore would result in potential indirect impacts. Although impacts to special-status species would be significant under the No-Action Alternative, implementation of mitigation and conservation measures, such as the preparation of the Micronesia Biosecurity Plan and Hazard Analysis and Critical Control Points planning will reduce the potential impacts from invasive species to less than significant. Even though the potential impacts under the No-Action Alternative would be less than significant, those impacts would be relatively greater than those identified in the materially smaller current proposed action.

4.6.9 Marine Biological Resources

For the No-Action Alternative, the impacts to marine biological resources would be the same as those described for Alternative 2 in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.2.7: Summary of Impacts, page 118 and Section 11.2.8: Summary of Essential Fish Habitat Assessment, pages 11-123 to 11-124). While less than significant impacts to marine biological resources would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4, impacts under the No-Action Alternative would be of greater intensity than those for the proposed action in this SEIS due to the larger proposed footprint and number of the Marines and dependents that would arrive on Guam.

4.6.10 Cultural Resources

For the No-Action Alternative, impacts to cultural resources would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 12: Cultural Resources, Section 12.2.3: Preferred Alternative (Alternative 2), pages 12-57 to 12-62). The No-Action Alternative would adversely affect 12 historic properties, while the action alternatives discussed in Chapter 4 would adversely affect historic properties as follows:

- Alternative A: 21 historic properties. Seven unevaluated buildings could also be affected.
- Alternative B: 18 historic properties. Seven unevaluated building could also be affected.
- Alternative C: 17 historic properties. Twelve unevaluated buildings could also be affected.

- Alternative D: 10 historic properties. Thirteen unevaluated archaeological locations, and 8 unevaluated buildings could also be affected.
- Alternative E: 17 historic properties. Fourteen unevaluated buildings could also be affected.

The historic properties affected under the No-Action Alternative do not include utility-related construction such as the well development area, which is analyzed under the current proposed action and would affect an additional 10 historic properties and 6 unevaluated structures. The No-Action Alternative and the five action alternatives also have the potential to result in significant long-term, direct impacts to culturally important resources that are not historic properties. These significant impacts would be mitigated through measures identified in the 2011 PA, regardless of which alternative was selected for implementation. In addition, the substantially greater number of Marines and their dependents under the No-Action Alternative, as compared to the proposed action in this SEIS, would potentially result in increased accidental or inadvertent damage to historic properties, especially Latte Stone Park (GHPI Number 66-08-0141). The resulting significant long-term, direct impacts to cultural resources would be mitigated through the 2011 PA stipulation on Cultural Resources Awareness orientation.

4.6.11 Visual Resources

For the No-Action Alternative, impacts for visual resources would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.2.3: Preferred Alternative (Alternative 2), pages 13-69 to 13-72). There would be significant impacts to visual resources under the No-Action Alternative that may be reduced to less than significant through the implementation of potential mitigation measures. By comparison, there would be less than significant impacts on visual resources under the action alternatives discussed in Chapter 4, as a result of less development associated with the reduced number of Marines and dependents that would arrive on Guam.

4.6.12 Ground Transportation

For the No-Action Alternative, impacts to ground transportation would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 6, Chapter 4: Roadways, Section 4.2.2.2: Preferred Alternative (Alternative 2), pages 4-88 to 4-89). Impacts to ground transportation may become less than significant through the implementation of potential mitigation measures, specifically, the required roadway improvements. By comparison, action alternatives would also result in less than significant impacts to ground transportation.

4.6.13 Marine Transportation

For the No-Action Alternative, impacts to marine transportation would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 14: Marine Transport, Section 14.2.2.3: Apra Harbor, pages 14-11 to 14-14), but altered only by the start date of construction. The predicted level of use under the No-Action Alternative would be well below capacity of existing marine transportation resources, resulting in less than significant impacts. By comparison, the action alternatives discussed in Chapter 4 would result in a smaller increase in use due to the reduced magnitude of the proposed action.

4.6.14 Utilities

Electrical Power

For the No-Action Alternative, impacts to electrical power would be the same as described in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.2.2: Power, pages 3-47 to 3-51). Less than significant impacts to power would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4. However, upgrades to off-base electrical transmission and generation systems would be required to support the No-Action Alternative, while no upgrades to existing generating facilities would be required as a result of implementing the proposed action alternatives; and the total estimated increase in electrical demand would be three times greater under the No-Action Alternative.

Potable Water

For the No-Action Alternative, impacts for potable water would be similar to those described in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.2.3: Potable Water, pages 3-51 to 3-67). However, since the 2010 Final EIS was issued, there have been several improvement projects (completed, in-progress, or planned) for the Air Force water system. These improvements include refurbishing the Tumon-Maui well and five Marbo wells, slip lining some of the water mains to reduce leaks, and repairs to the Mount Santa Rosa Water Storage Tank to eliminate leaks. These initiatives have reportedly reduced water demand through leak elimination. The refurbished wells improve the reliability of the water supply with the Marbo wells by adding an estimated 0.23 MGd (0.87 MLd), and the Tumon-Maui well by adding up to 1.3 MGd (4.9 MLd) to the water supply when put in service. In addition, five new wells, in progress during the 2010 Final EIS preparation, have been completed at AAFB and are now in production. The 2010 Final EIS assessment included the five new planned wells at AAFB in the impacts analysis, but not the other improvements. Those other improvements should reduce the impact of the No-Action Alternative from what was in the 2010 Final EIS for the DoD water system.

The GWA water system remains much the same as presented in the 2010 Final EIS. There have been some improvements made, mostly in leak detection and repair, well maintenance, and the installation of several new wells. The general water system, however, remains similar to that analyzed in the 2010 Final EIS. The DoD system reportedly would have increased excess water production capability, and could therefore offer excess water to the GWA should the need arise. The No-Action Alternative indirect impacts to the GWA water system would be the same as presented in the 2010 Final EIS for all subcategories (supply, transmission, and distribution).

Since completion of the 2010 Final EIS, the NGLA has been the subject of a major study by the USGS with support from WERI and others. Under the No-Action Alternative the estimated daily average groundwater withdrawals from the NGLA to meet potable water demand would be 5.8 MGd (22.0 MLd), as compared to 1.7 MGd (6.4 MLd) for the five action alternatives. The 2010 Final EIS concluded that groundwater withdrawals from the NGLA would result in less than significant impacts. However, results from the new USGS study, which was completed in 2013 (USGS 2013a), indicate that the five action alternatives would result in localized significant impacts to the NGLA but would be a less than significant impact to the NGLA overall. Therefore, it is assumed that the greater groundwater withdrawals under the No-Action Alternative would have similar, but greater localized significant impacts to the NGLA that would be mitigated as described for the action alternatives. The ramifications of this new information on the No-Action Alternative would be that the impacts assessment contained in the 2010 Final EIS would be similar but that the potable water solution would likely require an increased number of new wells above that proposed for the preferred alternative.

Wastewater

For the No-Action Alternative, impacts to wastewater would be similar to those described in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.2.4: Wastewater, pages 3-69 to 3-81), with the additional significant but mitigable impact to the collection system from AAFB to the Northern District WWTP. There have been some improvements in the operation of the Northern District WWTP since the 2010 Final EIS assessment was prepared. In 2013, the primary treatment system at the Northern District WWTP was repaired and upgraded in accordance with a 2011 Court Order. A capacity evaluation following the completion of the primary treatment upgrades has shown the Northern District WWTP has an operational capacity to treat wastewater to primary treatment standards of up to 9 MGd (34 MLd). It should be noted this limit is imposed by the 2011 Court Order, and is not a hydraulic limitation as the plant has a design capacity of 12 MGd (45 MLd). Issuance of the 2013 NPDES permits established effluent quality requirements consistent with secondary treatment and Guam Water Quality Standards, including those for nutrients. The Northern District WWTP and the Agaña WWTP currently cannot meet the permitted discharge limits, and are in non-compliance with the NPDES permit. Connection to a WWTP that does not meet NPDES permit conditions is a significant impact. As a result, the No-Action Alternative and the five proposed action alternatives would have similar significant impacts. The potential mitigation measure for the No-Action Alternative would be to seek other funding to upgrade these wastewater treatment plants in total capacity, treatment systems, and other wastewater infrastructure improvements.

Solid Waste

For the No-Action Alternative, impacts to solid waste would be similar to those described in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.2.5: Solid Waste, pages 3-81 to 3-83). However, the solid waste existing condition on Guam has changed significantly since the 2010 Final EIS was issued. This change is due to the opening of the new GovGuam Layon Landfill at Dandan. Now that this landfill is open, all acceptable MSW from existing DoD facilities on Guam is disposed at Layon Landfill. Required transfer stations and road improvements have also been completed and are operational. Less than significant impacts to solid waste would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4. Although impacts would be similar, the estimated increase in solid waste generation under the proposed action alternatives would be roughly 1/3 that of the No-Action Alternative. This would extend the life of the Layon Landfill over that under the No-Action Alternative.

Information Technology and Communications

The IT/COMM requirements for the No-Action Alternative would be similar to that for the action alternatives discussed in Chapter 4, with a less than significant impact, with the potential for brief outages during construction. The No-Action Alternative intra-base (cantonment area and family housing areas) would require a somewhat larger communication network because these areas would be larger than the action alternatives. However, the intra-base and off-base connectivity requirements would be the same in order to meet the Marine Corps IT/COMM criteria.

4.6.15 Socioeconomics and General Services

For the No-Action Alternative, the potential population, economic, public service, sociocultural, and land acquisition impacts would be the same as those described in the 2010 Final EIS (Volume 2, Chapter 16: Socioeconomics and General Services, Section 16.2.2: Proposed Action, pages 16-73 to 16-156). The action alternatives discussed in Chapter 4 would be substantially different from the No-Action Alternative. The population projections for the action alternatives are of a substantially lesser magnitude

than those presented in the No-Action Alternative due to a change in the proposed action being analyzed, including:

- Fewer active duty Marines - compared to the No-Action Alternative, the number of active duty Marines would be 42% lower for the action alternatives (from 8,552 to 5,000).
- Fewer military dependents of active duty Marines - military dependents are lower by 86% (from approximate 9,000 to approximately 1,300). The disproportionate decline in the number of dependents is due to a change in composition of active duty Marines. Under the action alternatives, two-thirds of active duty Marines would be rotational - spending 6 months per deployment to Guam - and would not be accompanied by dependents.
- Singular focus on the Marine Corps relocation - compared to the No-Action Alternative, the action alternatives do not assess impacts related to a potential DON nuclear-powered aircraft carrier berthing or a potential AAMDTF, or any connected actions such as roadways or utilities construction that are not directly associated with cantonment or LFTRC operations.
- An extended construction period - construction work resulting from implementation of the proposed action is expected to begin in 2015; construction would ramp up for a couple of years and then an extended period of construction activity would occur from 2017 through 2023, and then begin to taper off from 2024 until the final year of construction in 2027.

The action alternatives analyzed in Chapter 4 would avoid such a population peak and many of the social problems that can result from sharp population increases and subsequent sharp declines in population (a "Boomtown" economy, Appendix D).

4.6.16 Hazardous Materials and Waste

For the No-Action Alternative, the environmental impacts associated with hazardous materials and waste would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 17: Hazardous Materials and Waste, Section 17.2.3: Preferred Alternative (Alternative 2), page 17-55). The No-Action Alternative would result in less than significant impacts from hazardous materials and waste but the amount of hazardous materials and waste used and generated would be 64% greater than the levels described for the action alternatives discussed in Chapter 4 due to the increased personnel and operations under the No-Action Alternative.

4.6.17 Public Health and Safety

For the No-Action Alternative, impacts to public health and safety would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 18: Public Health and Safety, Section 18.2.3: Alternative 2 (Preferred Alternative), page 18-23). The No-Action Alternative and the action alternatives discussed in Chapter 4 would result in similar impacts to public health and safety with less than significant impacts during construction and no impacts during operations, except for Alternative C and Alternative E, which would have a significant, unmitigable impact associated with operational safety (explosives safety).

4.6.18 Environmental Justice and the Protection of Children

For the No-Action Alternative, the potential environmental justice and the protection of children impacts would be the same as those described for the preferred alternative (Alternative 2) in the 2010 Final EIS (Volume 2, Chapter 19: Environmental Justice and Protection of Children, Section 19.2.3: Preferred Alternative (Alternative 2), pages 19-18 to 19-19). There would be no significant noise impacts, and no land acquisition impacts disproportionately affecting minority and low-income populations. The

magnitude of potential impacts to environmental justice under the No-Action Alternative would be larger than the potential impacts under the action alternatives discussed in Chapter 4, due to the increased scope and size of the No-Action Alternative. The action alternatives would avoid or significantly reduce environmental justice issues that can result from a substantial and rapid influx of people to a single island location, as proposed in the No-Action Alternative. There would be no significant noise impacts under the action alternatives. In addition, impacts to the economy, public health services, and social services relating to environmental justice would be reduced. The "boom and bust" cycle of population growth and decline proposed in the No-Action Alternative would be substantially alleviated under the action alternatives, reducing potential adverse impacts to the economy (and thus to low-income residents). Access to public health and social services would continue to be problematic under the action alternatives due to the increase in population accessing these services, but the level of strain to public health and social services would be lessened.

4.7 SUMMARY OF IMPACTS AND POTENTIAL MITIGATION MEASURES FOR THE MAIN CANTONMENT/HOUSING ALTERNATIVES

Table 4.7-1 summarizes the impacts and potential mitigation measures of each cantonment/family housing alternative, including the No-Action Alternative. BMPs to minimize impacts would be employed during construction (see Section 2.8). Significant impacts are highlighted in yellow in Table 4.7-1 and any potential mitigation measures are identified immediately following the associated impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
GEOLOGICAL AND SOIL RESOURCES					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Topography ***LSI*** Less than significant direct, long-term impacts to topography and slope stability from minor changes in surface elevations due to excavation and filling. Earthwork would include an estimated 3,159,000 yd^3 (2,415,230 m^3) of cut and 2,483,000 yd^3 (1,898,391 m^3) of fill. Alternative A would involve less excavation than all other alternatives except Alternative C and the No-Action Alternative. Construction BMPs would reduce impacts to a less than significant level.	Topography ***LSI*** Direct, long-term impacts to topography and slope stability similar to Alternative A. Earthwork would include 3,245,000 yd^3 (2,480,980 m^3) of cut and 2,731,000 yd^3 (2,087,999 m^3) of fill, more than Alternatives A and C but less than Alternative D and the No-Action Alternative. Construction BMPs would reduce impacts to a less than significant level.	Topography ***LSI*** Direct, long-term impacts to topography and slope stability similar to Alternative A. Earthwork would include 3,088,000 yd^3 (2,360,945 m^3) of cut and 2,485,700 yd^3 (1,900,454 m^3) of fill, less than all other alternatives. Construction BMPs would reduce impacts to a less than significant level.	Topography ***LSI*** Direct, long-term impacts to topography and slope stability similar to Alternative A. Earthwork would include 3,510,000 yd^3 (2,683,589 m^3) of cut and 2,618,000 yd^3 (2,001,606 m^3) of fill, resulting in a net cut of 892,000 yd^3 (681,983 m^3) and including grading a steep slope for a water tank. Alternative D would involve the second largest excavation volume of all five action alternatives, but substantially less than the No-Action Alternative. Construction BMPs would reduce impacts to a less than significant level.	Topography ***LSI*** Direct, long-term impacts to topography and slope stability similar to Alternative A. Earthwork would include 3,732,871 yd^3 (2,853,984 m^3) of cut (excavation) and 2,958,469 yd^3 (2,261,911 m^3) of fill, resulting in a net of 774,402 yd^3 (92,072 m^3) the largest amount of excavation of any of the action alternatives but substantially less than the No-Action Alternative. Construction BMPs would reduce impacts to a less than significant level.	Topography ***LSI*** Direct, long-term impacts to topography and slope stability from minor changes in surface elevations due to excavation and filling. Specific cut/fill estimates are not available but the construction footprint would be 78% larger than for Alternative A and would involve a substantially larger amount of excavation. Construction BMPs would reduce impacts to a less than significant level.
Soils ***LSI*** Less than significant direct, short-term impacts to soils from erosion. No indirect short-term impacts expected. Potential increase in construction-related erosion minimized with engineering controls per 22 GAR, Chapter 10 Guam Soil Erosion and Sediment Control Regulations and construction stormwater BMPs as per the Construction General Permit. ***NI*** No prime farmland is identified in the development footprint. No direct or indirect impacts to agricultural soils.	Soils ***LSI*** Direct, short-term impacts to soils similar to Alternative A. No indirect short-term impacts expected. Less construction/ development (approximately 320 acres [130 ha]) would occur in a previously undeveloped area as compared with Alternative A. ***NI*** No prime farmland is identified in the development footprint. No direct or indirect impacts to agricultural soils.	Soils ***LSI*** Direct, short-term impacts to soils similar to Alternative A. No indirect short-term impacts expected. ***NI*** No prime farmland is identified in the development footprint. No direct or indirect impacts to agricultural soils.	Soils ***LSI*** Direct, short-term impacts to soils similar to Alternative A. No indirect short-term impacts expected. ***NI*** No prime farmland is identified in the development footprint. No direct or indirect impacts to agricultural soils.	Soils ***LSI*** Direct, short-term impacts to soils similar to Alternative A. No indirect short-term impacts expected. ***NI*** No prime farmland is identified in the development footprint. No direct or indirect impacts to agricultural soils.	Soils ***LSI*** The No-Action Alternative's larger construction footprint would result in higher potential for direct and indirect impacts to soils from erosion, though still less than significant with implementation of BMPs to reduce and control runoff. More runoff potential over the longer term due to substantially larger impervious surface area (883 acres [357 ha]) compared to the action alternatives. ***NI*** No prime farmland is identified in the development footprint. No direct or indirect impacts to agricultural soils.
Sinkholes ***LSI*** There are 43 topographic features that may contain sinkholes in the Alternative A footprint. For any sinkholes discovered before or during construction, BMPs would include compliance with 22 GAR Chapter 10 § 10106F, including an environmental and hydrogeologic assessment to ensure adverse effects will not result. With these BMPs, and since no sinkholes would be filled that would adversely affect site drainage, no adverse impacts to sinkholes would occur. Construction of Alternative A would have less than significant direct, short-term impacts to sinkholes.	Sinkholes ***LSI*** Under Alternative B, 41 features were preliminarily identified as topographic features that may contain sinkholes. Impacts and BMPs would be as described for Alternative A. No adverse impact given compliance with 22 GAR Chapter 10 § 10106F.	Sinkholes ***LSI*** Under Alternative C, 28 features were preliminarily identified as topographic features that may contain sinkholes. Impacts and BMPs would be as described for Alternative A. No adverse impact given compliance with 22 GAR Chapter 10 § 10106F.	Sinkholes ***LSI*** Under Alternative D, 15 features were preliminarily identified as topographic features that may contain sinkholes. Impacts and BMPs would be as described for Alternative A. No adverse impact given compliance with 22 GAR Chapter 10 § 10106F.	Sinkholes ***LSI*** Under Alternative E, 34 features were preliminarily identified as topographic features that may contain sinkholes. Impacts and BMPs would be as described for Alternative A. No adverse impact given compliance with 22 GAR Chapter 10 § 10106F.	Sinkholes ***LSI*** Approximately 62 features were preliminarily identified as sinkholes or depressions that may contain sinkholes within or on the perimeter of the No-Action Alternative footprint. By comparison, 43 similar features have been identified for Alternative A (the most of all action alternatives). The No-Action Alternative BMPs would include compliance with 22 GAR Chapter 10 § 10106F for protection of sinkholes, so there would be no adverse impacts to sinkholes.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Geologic Hazards ***LSI*** Potential direct and indirect short-term impacts associated with geologic hazards during construction of cantonment and family housing facilities, schools and utilities. Facilities would be on level areas not subject to slope instability. Structural hazards associated with earthquake-generated fault rupture/ground shaking (there are 3 minor bedrock faults mapped in the Alternative A footprint) would be minimized with application of UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 (USACE 2013) during design and construction. Compliance with 22 GAR Chapter 10 § 10106F would minimize potential geologic hazards associated with sinkholes.	Geologic Hazards ***LSI*** Direct and indirect short-term impacts associated with geologic hazards and the application of BMPs would be similar to Alternative A.	Geologic Hazards ***LSI*** Direct and indirect short-term impacts associated with geologic hazards and the application of BMPs would be similar to Alternative A, except there are 2 minor bedrock faults mapped within the Alternative C footprint.	Geologic Hazards ***LSI*** Direct and indirect short-term impacts associated with geologic hazards and the application of BMPs would be similar to Alternative A, except there are no known bedrock faults mapped within the Alternative D footprint.	Geologic Hazards ***LSI*** Direct and indirect short-term impacts associated with geologic hazards and the application of BMPs would be similar to Alternative A.	Geologic Hazards ***LSI*** Direct and indirect short-term impacts associated with geologic hazards and the application of BMPs would be similar to Alternative A (there are 3 minor bedrock faults mapped within the development footprint for the No-Action Alternative).
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Topography ***NI*** No direct or indirect impacts to topography because no large scale grading or changes to elevation would occur during operations.	Topography ***NI*** No direct or indirect impacts to topography because no large scale grading or changes to elevation would occur during operations.	Topography ***NI*** No direct or indirect impacts to topography because no large scale grading or changes to elevation would occur during operations.	Topography ***NI*** No direct or indirect impacts to topography because no large scale grading or changes to elevation would occur during operations.	Topography ***NI*** No direct or indirect impacts to topography because no large scale grading or changes to elevation would occur during operations.	Topography ***NI*** No direct or indirect impacts to topography because no large scale grading or changes to elevation would occur during operations.
Soils ***LSI*** Potential direct long-term impacts to soils from erosion associated with minimal surface disturbance during maintenance activities. Impacts would be reduced by implementation of construction stormwater BMPs.	Soils ***LSI*** Potential for erosion impacts during maintenance activities as described for Alternative A. BMPs would be applied to keep impacts less than significant.	Soils ***LSI*** Potential for erosion impacts during maintenance activities as described for Alternative A. BMPs would be applied to keep impacts less than significant.	Soils ***LSI*** Potential for erosion impacts during maintenance activities as described for Alternative A. BMPs would be applied to keep impacts less than significant.	Soils ***LSI*** Potential for erosion impacts during maintenance activities as described for Alternative A. BMPs would be applied to keep impacts less than significant.	Soils ***LSI*** Potential for erosion impacts during maintenance activities as described for Alternative A. BMPs would be applied to keep impacts less than significant.
Sinkholes ***LSI*** BMPs and compliance with 22 GAR Chapter 10 § 10106F would reduce potential impacts if maintenance activities would occur near topographic features that may contain sinkholes (43 such features have been identified in the Alternative A footprint).	Sinkholes ***LSI*** Potential impacts and application of BMPs would be as described for Alternative A (except that 41 features that may contain sinkholes have been identified in the Alternative B footprint).	Sinkholes ***LSI*** Potential impacts and application of BMPs would be as described for Alternative A (except that 28 features that may contain sinkholes have been identified in the Alternative C footprint).	Sinkholes ***LSI*** Potential impacts and application of BMPs would be as described for Alternative A (except that 15 features that may contain sinkholes have been identified in the Alternative D footprint).	Sinkholes ***LSI*** Potential impacts and application of BMPs would be as described for Alternative A (except that 34 features that may contain sinkholes have been identified in the Alternative E footprint).	Sinkholes ***LSI*** Potential impacts and application of BMPs would be as described for Alternative A (except that 62 features that may contain sinkholes have been identified in the No-Action Alternative footprint).
Geologic Hazards ***LSI*** Operations would result in less than significant direct and indirect long term impacts associated with geologic hazards. Minimal hazards would be associated with slope instability and liquefaction. Potential structural damage or injuries during operations from seismic ground-shaking and fault rupture would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 (USACE 2013) during design and construction. Sinkhole BMPs during maintenance operations would minimize potential geologic hazards associated with sinkholes.	Geologic Hazards ***LSI*** Due to consistency in operations and application of BMPs regardless of alternative, and relatively small differences in site conditions, impacts associated with geologic hazards during operations would be similar to the description for Alternative A.	Geologic Hazards ***LSI*** Due to consistency in operations and application of BMPs regardless of alternative, and relatively small differences in site conditions, impacts associated with geologic hazards during operations would be similar to the description for Alternative A.	Geologic Hazards ***LSI*** Due to consistency in operations and application of BMPs regardless of alternative, and relatively small differences in site conditions, impacts associated with geologic hazards during operations would be similar to the description for Alternative A.	Geologic Hazards ***LSI*** Due to consistency in operations and application of BMPs regardless of alternative, and relatively small differences in site conditions, impacts associated with geologic hazards during operations would be similar to the description for Alternative A.	Geologic Hazards ***LSI*** Due to consistency in operations and application of BMPs regardless of alternative, and relatively small differences in site conditions, impacts associated with geologic hazards during operations would be similar to the description for Alternative A.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
WATER RESOURCES					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Surface Water ***NI*** No surface waters are located within or near the construction area. No structures would be constructed within a flood zone.	Surface Water ***NI*** No surface waters are located within or near the construction area. No structures would be constructed within a flood zone.	Surface Water ***NI*** No surface waters are located within or near the construction area. No structures would be constructed within a flood zone.	Surface Water ***LSI*** Potential short-term increase in stormwater runoff, erosion, and sedimentation could have indirect effects on wetlands. Impacts would be minimized with SWPPPs and BMPs. No facilities would be constructed in flood zones, but some stormwater detention basins may be constructed.	Surface Water ***NI*** No surface waters are located within or near the construction area. No structures would be constructed within a flood zone.	Surface Water ***NI*** No surface waters are located within or near the construction area. No structures would be constructed within a flood zone.
Groundwater ***SI-M*** Potential increases in the rate of sewage spills associated with the induced civilian growth and construction/DoD workforce would result in significant indirect impacts to groundwater quality. ***Potential Mitigation Measures*** **Refurbishment of the GWA sewage system would mitigate significant impacts to groundwater resources during construction. The FY 2014 NDAA requires the EAC to develop an implementation plan that addresses public infrastructure requirements necessary to support the preferred alternative. To support this implementation plan, DoD assessed GWA's water and wastewater systems that may be affected by the preferred alternative. The water and wastewater assessment recommended the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Also, Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.**	Groundwater ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as Alternative A.**	Groundwater ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as Alternative A.**	Groundwater ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as Alternative A.**	Groundwater ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as Alternative A.**	Groundwater ***SI-M*** Impacts would be similar to Alternative A but even more severe because of the substantially larger workforce population required during construction for the No-Action Alternative. ***Potential Mitigation Measures*** **Mitigation would be the same as Alternative A.**
LSI Short-term, direct impacts from potential for stormwater to reach NGLA. Stormwater runoff and sinkhole protection measures would serve to protect groundwater quality. Siting and construction of wells would be implemented according to GEPA regulations.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Nearshore Waters ***SI*** Increased wastewater flow associated with induced civilian and construction/DoD workforce growth under Alternative A would result in a significant and unmitigable indirect impact to nearshore waters from increased wastewater discharge from the Northern District WWTP outfall. The Northern District WWTP is non-compliant with the current NPDES permit and increasing the wastewater discharge from a non-compliant treatment plant would be a significant indirect impact during the period of non-compliance. Until the WWTP upgrades are completed (see Operation Impacts below) there would be an indirect and unmitigable significant impact to nearshore waters during construction.	Nearshore Waters ***SI*** Impacts would be similar to Alternative A.	Nearshore Waters ***SI*** Impacts would be similar to Alternative A.	Nearshore Waters ***SI*** Induced civilian and construction/DoD workforce growth under Alternative D would result in a significant unmitigable indirect impact to nearshore waters from increased wastewater discharge from the Northern District and Agaña WWTPs that are non-compliant with the current NPDES permits. Increasing the wastewater discharge from a non-compliant treatment plant would be a significant indirect impact during the period of non-compliance. Until the WWTP upgrades are completed there would be an indirect and unmitigable significant impact to nearshore waters during construction.	Nearshore Waters ***SI*** Impacts would be similar to Alternative A.	Nearshore Waters ***SI*** Impacts would be similar to those described under Alternative A, except that with the longer duration of construction and larger construction workforce projection as compared to the 2012 Roadmap Adjustments, the related increase in wastewater discharge from the Northern District WWTP would be substantially larger under the No-Action Alternative.
NI Short-term increase in Stormwater runoff would not discharge to nearshore waters with adherence to the Construction General Permit, BMPs, and SWPPPs.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.
Wetlands ***NI*** No wetlands are located within or near the construction areas.	Wetlands ***NI*** Impacts would be similar to Alternative A.	Wetlands ***NI*** Impacts would be similar to Alternative A.	Wetlands ***SI-M*** Direct impact (fill) of approximately 0.1 acre of potentially jurisdictional wetland area. ***Potential Mitigation Measures*** **If LEDPA, a Section 404 permit would be obtained for unavoidable impacts to jurisdictional wetlands and direct impacts would be mitigated by creating new wetlands, restoring or enhancing existing wetlands, or preserving existing wetland areas on Guam to, at a minimum, replace the area filled.** ***LSI*** Short-term, indirect impact from potential increase in construction-related runoff and sedimentation to down gradient wetlands.	Wetlands ***NI*** Impacts would be similar to Alternative A.	Wetlands ***NI*** Impacts would be similar to Alternative A.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Surface Water ***NI*** No surface waters are located within or near the project area. Implementation of BMPs and LID measures to ensure no off-site transport of excess runoff, sediment, or pollutants.	Surface Water ***NI*** Impacts and application of BMPs and LID measures would be as described for Alternative A.	Surface Water ***NI*** Impacts and application of BMPs and LID measures would be as described for Alternative A.	Surface Water ***LSI*** Indirect impacts on wetlands from potential increase in stormwater runoff and associated pollutants.	Surface Water ***NI*** Impacts and application of BMPs and LID measures would be as described for Alternative A.	Surface Water ***SI-M*** Although no surface waters are located on or near the cantonment/housing site for the No-Action Alternative, the large increase in island-wide demand on the existing Guam sewer collection systems, due to the large amount of induced growth projected (as compared to the five SEIS action alternatives), would result in significant adverse indirect impacts from increased potential for sewage spills anywhere on the central sewer collection system. Such spills could affect nearby surface waters anywhere they occurred.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
					Potential Mitigation Measures **Mitigation would be the same as defined in the 2010 ROD.** ***LSI*** Total amount of impervious area would increase by 883 acres (357 ha), resulting in potential increase in stormwater runoff, erosion, and sedimentation.
Groundwater ***SI-M*** Long-term increase in annual groundwater production of 1.7 MGd could result in a localized significant impact to the NGLA. Also, further deterioration to the existing GWA interceptor sewer system from AAFB to the Northern District WWTP could result in failure and significant impacts to groundwater quality from wastewater leaks. ***Potential Mitigation Measures*** **The DoD would, as appropriate, implement enhanced water conservation measures for the proposed action, improve existing DoD water systems to reduce system leaks, adjust pumping rates at DoD wells, use existing wells, and/or increase the use of surface water from Fena Reservoir, in order to reduce withdrawals from the NGLA.** **The DoD would continue to support the GWRDG and would support USGS's recommendation to rehabilitate and expand the hydrologic data collection network and monitoring necessary to ensure sustainable management of NGLA.** **As required in the FY 2014 NDAA, the EAC implementation plan will address public infrastructure requirements necessary to support the preferred alternative, as well as address groundwater-related issues including technical and financial assistance for an updated and expanded NGLA monitoring well network and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the NGLA monitoring well network. To support this implementation plan, DoD assessed GWA's water and wastewater	Groundwater ***SI-M*** Impacts would be similar to Alternative A. However, less area converted to impervious area than under Alternative A. The increased groundwater withdrawal rate would be the same. Potential impacts to groundwater from increased flow through the GWA interceptor sewer system would be the same as Alternative A ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Groundwater ***SI-M*** Impacts would be similar to Alternative A. However, less area converted to impervious area than under Alternative A. The increased groundwater withdrawal rate would be the same. Potential impacts to groundwater from increased flow through the GWA interceptor sewer system would be the same as Alternative A ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Groundwater ***SI-M*** Impacts would be similar to Alternative A. However, more area converted to impervious area than under Alternative A. The increased groundwater withdrawal rate would be the same. Potential impacts to groundwater from increased flow through the GWA interceptor sewer system would be the same as Alternative A ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A, but would include recommended upgrades of both the Agaña WWTP and Northern District WWTPs.**	Groundwater ***SI-M*** Impacts would be similar to Alternative A. However, less area converted to impervious area than under Alternative A. The increased groundwater withdrawal rate would be the same. Potential impacts to groundwater from increased flow through the GWA interceptor sewer system would be the same as Alternative A ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Groundwater ***SI-M*** Long-term increase in annual groundwater production of 5.8 MGd would result in a localized significant impact to the NGLA ***Potential Mitigation Measures*** **Mitigation would be the same as Alternative A.** ***SI-M*** The large increase in island-wide demand on the existing Guam sewer collection systems, due to the large amount of induced growth projected (as compared to the five SEIS action alternatives), would result in significant adverse indirect impacts from increased potential for sewage spills anywhere on the central sewer collection system. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
systems that may be affected by the preferred alternative. The water and wastewater assessment recommended an updated and expanded NGLA monitoring well network and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.					
LSI Minor long-term increase in aquifer recharge rates with an additional 273 acres (110 ha) of impervious area; direct impact from increase in pollutant loading potential.	***LSI*** Minor long-term increase in aquifer recharge rates with an additional 176 acres (71 ha) of impervious area; direct impact from increase in pollutant loading potential.	***LSI*** Minor long-term increase in aquifer recharge rates with an additional 126 acres (51 ha) of impervious area; direct impact from increase in pollutant loading potential.	***LSI*** Minor long-term increase in aquifer recharge rates with an additional 319 acres (129 ha) of impervious area; direct impact from increase in pollutant loading potential.	***LSI*** Minor long-term increase in aquifer recharge rates with an additional 280 acres (113 ha) of impervious area at Finegayan; direct impact from increase in pollutant loading potential.	***LSI*** Minor long-term increase in aquifer recharge rates with an additional 883 acres (357 ha) of impervious area; direct impact from increase in pollutant loading potential.
Nearshore Waters ***SI-M*** Operation of the cantonment and family housing facilities under Alternative A would result in a significant but mitigable impact to nearshore waters from increased wastewater discharge from the Northern District WWTP outfall. The Northern District WWTP is non-compliant with the treatment standards required by the current NPDES permit and increasing the wastewater discharge from a non-compliant treatment plant would be a significant indirect impact during the period of non-compliance. However, upgrades to bring the Northern District WWTP into compliance with the permit are expected to be completed early in the operational phase of the proposed action and such upgrades would mitigate the impact to a less than significant level. ***Potential Mitigation Measures*** **Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate significant impacts to the wastewater system on Guam once the upgrades are completed. In addition, refurbishing the main GWA sewer lines from AAFB to the Northern District WWTP along Routes 3 and 9 would mitigate potential failure of the concrete reinforced sewer lines that are in a state of deterioration. The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the**	Nearshore Waters ***SI-M*** Impacts associated with WWTP discharge to nearshore waters would be similar to those described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as described under Alternative A.**	Nearshore Waters ***SI-M*** Impacts associated with WWTP discharge to nearshore waters would be similar to those described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as described under Alternative A.**	Nearshore Waters ***SI-M*** Impacts associated with WWTP discharge to nearshore waters would be similar to those described under Alternative A but would involve discharge from both the Northern District and the Agaña WWTPs. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A, but would include recommended upgrades of both the Agaña WWTP and Northern District WWTPs.**	Nearshore Waters ***SI-M*** Impacts associated with WWTP discharge to nearshore waters would be similar to those described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as described under Alternative A.**	Nearshore Waters ***SI-M*** Impacts associated with WWTP discharge to nearshore waters would be similar to those described under Alternative A but would be more intensive because of the larger projected population increase under the No-Action Alternative. ***Potential Mitigation Measures*** **Mitigation would be the same as described under Alternative A.** ***SI-M*** The large increase in island-wide demand on the existing Guam sewer collection systems, due to the large amount of induced growth projected (as compared to the five SEIS action alternatives), would result in significant adverse indirect impacts from increased potential for sewage spills anywhere on the central sewer collection system. ***Potential Mitigation Measures*** **Mitigation would be the same as defined in the 2010 ROD.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	*Fineqayan/South Fineqayan (Alternative B)*	*Andersen Air Force Base (Alternative C)*	*Barrigada (Alternative D)*	*Fineqayan/Andersen Air Force Base (Alternative E)*	*No-Action Alternative*
preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. The water and wastewater assessment that DoD prepared to support the Implementation Plan recommended upgrades to the Northern District WWTP and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.					
NI No direct or indirect impact from stormwater runoff discharge from the project area to nearshore waters.	***NI*** Impacts would be similar to Alternative A, except that there would be greater vegetative cover than under Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***LSI*** Minor increase in runoff volume and pollutant loading potential.
Wetlands ***NI*** No wetlands are located within or near the project area.	Wetlands ***NI*** Impacts would be similar to Alternative A.	Wetlands ***NI*** Impacts would be similar to Alternative A.	Wetlands ***LSI*** Indirect, long-term impact on wetlands from potential minor increase in stormwater runoff and associated pollutants.	Wetlands ***NI*** Impacts would be similar to Alternative A.	Wetlands ***SI-M*** Although no wetlands are located on or near the cantonment/housing site for the No-Action Alternative, the large increase in island-wide demand on the existing Guam sewer collection systems, due to the large amount of induced growth projected (as compared to the five SEIS action alternatives), would result in significant adverse indirect impacts from increased potential for sewage spills anywhere on the central sewer collection system. Such spills could affect nearby wetlands anywhere they occurred. ***Potential Mitigation Measures*** **Mitigation would be the same as defined in the 2010 ROD.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
AIR QUALITY					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
LSI The construction phase direct short-term increase in emissions would be below the impact significance threshold. On-base construction site hot-spot particulate matter impact analysis estimated the total PM levels would be well below respective NAAQS, resulting in less than significant direct, short-term PM impacts during construction years. Construction phase off-base roadway hot-spot particulate matter, carbon monoxide, and mobile source air toxics impact conclusion found predicted levels would be well below the NAAQS, resulting in less than significant direct, short-term CO, PM, and MSAT impacts.	***LSI*** The construction phase direct short-term increase in emissions would be below the impact significance threshold. Construction phase increase in sulfur dioxide emissions within the Tanguisson nonattainment area (South Finegayan housing area) would be below the general conformity *de minimis level* and no formal conformity rule determination is required. On-base construction site hot-spot particulate matter impact analysis found the total PM levels predicted would be below respective NAAQS resulting in less than significant direct, short-term PM and MSAT impacts during construction years. Construction phase off-base roadway hot-spot particulate matter, carbon monoxide, and mobile source air toxics impact conclusion found predicted levels would be well below the NAAQS, resulting in less than significant direct, short-term CO, PM, MSAT impacts.	***LSI*** The construction phase direct short-term increase in emissions would be below the impact significance threshold. Short-term on-site hot spot PM impacts around construction sites would be less or similar to those under Alternative A. Project impacts of all carcinogenic and non-carcinogenic MSATs are considered acceptable. Off-site on road vehicle CO, PM, and MSATs hot-spot impact concentrations for Alternative C would be similar in magnitude to those predicted for Alternative A; predicted levels of PM and CO would be below the NAAQS.	***LSI*** The construction phase direct short-term increase in emissions would be below the impact significance threshold. Short-term on-site hot-spot PM impacts around construction sites would be anticipated as less or similar to those under Alternative A. Off-site on road vehicle CO, PM, and MSATs hot-spot impact concentrations for Alternative D would be similar to those predicted for Alternative A; predicted levels of PM and CO would be below the NAAQS. Project impacts of all non-carcinogenic MSATs are considered acceptable.	***LSI*** The construction phase direct short-term increase in emissions would be below the impact significance threshold. Under Alternative E, the short-term on-site hot-spot PM impacts near construction sites would be less than or similar to those under Alternative A, which is anticipated to have the greatest truck emissions impacts along the truck routes. Off-site on-road vehicle CO, PM, and MSATs hot-spot impact concentrations for Alternative E would be similar in magnitude to those predicted for Alternative A at the analyzed intersections according to similar traffic patterns. Predicted levels of PM and CO are well below the NAAQS resulting in less than significant hot-spot PM and CO impacts during the construction period. Similarly, the project impacts of all carcinogenic MSATs and all non-carcinogenic MSATs are also considered acceptable.	***LSI*** Impacts would be greater than each proposed alternative given the greater scale of construction activities. The construction phase increase in sulfur dioxide emissions within both Piti and Tanguisson nonattainment areas would be below the general conformity *de minimis level* and no formal conformity rule determination would be required. Impact conclusions would remain the same as described in the 2010 Final EIS.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
LSI Direct and indirect impacts associated with long-term operational phase off-base roadway hot-spot particulate matter, carbon monoxide, and mobile source air toxics from increased traffic congestion.	***LSI*** Impacts would be similar to Alternative A	***LSI*** Impacts would be similar to Alternative A. In addition, because AAFB is a Prevention of Significant Deterioration source, a permit modification could be required as a result of the proposed project. This determination would be made during the final design stage to ensure that the development on AAFB would be in compliance with applicable regulatory requirements.	***LSI*** Impacts would be similar to Alternative A	***LSI*** The estimated traffic congestion conditions under Alternative E would be comparable to those for Alternatives A and C. Given the low levels of CO and MSATs impact concentrations predicted under Alternative A and the comparable traffic congestion conditions at analyzed intersections under Alternative C as compared to Alternative A, the hot-spot impact of off-site on-road vehicle CO and MSATs emissions under Alternative E during operational years would be similar to Alternative A. Based on these findings, long-term operational phase air quality impacts under Alternative E are considered less than significant.	***LSI*** Impacts would be slightly greater than each proposed alternative given the greater scale of operational activities. Impact conclusions would remain the same as described in the 2010 Final EIS.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
NOISE					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
LSI Direct and indirect impacts from construction noise. Short-term construction noise affecting the nearest receptors at Finegayan would be 65.4 dB L_{eq}, which is below USEPA threshold guideline of 75 dBA L_{eq}. Receptors include 20 houses (70-75 people) along Route 3. Long-term noise emanating from the center of the cantonment/family housing area would be 54.5 and 51.5 dBA L_{eq}, respectively, and be well below FICUN guidelines.	***LSI*** Direct and indirect impacts from construction noise. Short-term construction noise affecting the nearest receptors at Finegayan would be 65.4 dB L_{eq}, which is below USEPA threshold guideline of 75 dBA L_{eq}. This alternative impacts 10 more houses (36 people) than under Alternative A. Long-term noise emanating from the center of the cantonment/family housing area would be 54.5 and 57.8 dBA L_{eq}, respectively, and be well below FICUN guidelines.	***LSI*** Direct and indirect impacts from construction noise. Short-term construction noise affecting the nearest receptors at Andersen AAFB would be 74.8 dB L_{eq} for family housing and 59 dB L_{eq} for cantonment. Similar to Alternative 1, 20 houses (75 people) would be impacted. Long-term noise emanating from the center of the cantonment/family housing area would be 50.4 and 57.8 dBA L_{eq}, respectively, and be well below FICUN guidelines.	***LSI*** Direct and indirect impacts from construction noise. Short-term construction noise affecting the nearest receptors at Barrigada would be 74.8 dB L_{eq} and within acceptable limits. 25 homes (92 people) would be impacted, which is the greatest and only slightly more than Alternative A. The extended construction period would further lessen impacts. Long-term noise emanating from the center of the cantonment/family housing area would be 62.4 and 56.4 dBA L_{eq}, respectively, and be well below FICUN guidelines.	***LSI*** Impacts would be similar to Alternative A and C. Direct and indirect impacts from construction noise. Short-term construction noise affecting the nearest receptors at Finegayan would be 65.4 dB Leq and within acceptable limits. 20 homes (70-75 people) would be impacted, which is similar to Alternative A. The proposed housing areas on AAFB would be located just outside the 65 dBA DNL Andersen AAFB airfield noise zones with approximately the same amount of area in each zone. Long-term noise emanating from the center of the cantonment area at Finegayan and the center of the housing area at AAFB would be well below FICUN guidelines.	***SI-M*** Construction noise would impact residences along Route 3. Impacts would be less than significant or significant but mitigable, depending on the location of construction activities. ***Potential Mitigation Measures*** **Construction sequencing, sound barriers, installation and periodic inspection of sound reducing devices on construction machinery, and shutting off idling equipment to reduce impacts to less than significant.**
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
LSI Long-term direct impact. Traffic noise would be below 66 dB and comply with Guam Department of Public Works standards. Long-term operations would be similar to an office park/residential setting.	***LSI*** Impacts would be similar to Alternative A. However, there would be slightly more traffic in a 1 mile (1.6 km) stretch.	***LSI*** Impacts would be similar to Alternative A. However, steady state noise would be primarily due to ongoing aircraft noise. Traffic noise would be less than other alternatives.	***LSI*** Impacts would be similar to Alternative A. However, steady state noise would primarily be from traffic noise near gates.	***LSI*** Finegayan cantonment would have similar impacts as Alternative A. AAFB family housing would have similar impacts as Alternative C. Steady state noise would be primarily due to ongoing aircraft noise.	***SI-M*** Significant operational impacts under No-Action Alternative would occur as a result of traffic noise. ***Potential Mitigation Measures*** **Traffic noise would be reduced using sound walls at selected locations where the impacts are greatest and would reduce noise impacts to less than significant levels.**
AIRSPACE					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
NI Construction associated with the cantonment/family housing facilities consist of support, maintenance/storage, housing, and non-live fire training functions; there would be no changes to airspace.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
NI Operation and functions associated with the cantonment/family housing facilities consist of support, maintenance/storage, housing, and non-live fire training functions; there would be no changes to airspace.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
LAND AND SUBMERGED LAND USE					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
NI There would be changes to land use initiated during construction; however, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource. See operational impacts.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Loss of Valued Use ***NI*** No change to a land use valued by the community.	Loss of Valued Use ***NI*** Impacts would be similar to Alternative A.	Loss of Valued Use ***NI*** Impacts would be similar to Alternative A.	Loss of Valued Use ***NI*** Impacts would be similar to Alternative A.	Loss of Valued Use ***NI*** Impacts would be similar to Alternative A.	Loss of Valued Use ***NI*** Impacts would be similar to Alternative A.
Public Access ***NI*** There would be no new access restrictions imposed on the public.	Public Access ***SI-M*** Short- and long-term direct impact from restriction of public access to Latte Stone Park. This alternative would have a greater impact than Alternatives A, C, D, or E. ***Potential Mitigation Measures*** **The DoD would work with the community to provide access to Latte Stone Park to the extent practicable.**	Public Access ***NI*** Impacts would be similar to Alternative A.	Public Access ***NI*** Public access to the ballfield in the southern portion of the site would be restricted; however, The new access restriction is not considered an impact because the ballfield is not unique and there are other ballfields in proximity.	Public Access ***NI*** Impacts would be similar to Alternative A.	Public Access ***SI*** Direct long-term unmitigable impact due to public access restrictions to the jogging trail at Former FAA parcel. ***SI-M*** New public access restrictions to the Latte Stone Park at South Finegayan. ***Potential Mitigation Measures*** **The DoD would work with the community to provide access to Latte Stone Park to the extent practicable.**
Compatibility with Current and Future Use ***LSI*** Long-term impact from increase in land use density and decrease in open space on-base. ***NI*** Compatible with existing and proposed land uses in the vicinity.	Compatibility with Current and Future Use ***LSI*** Impacts would be similar to Alternative A, except more open space would remain at Finegayan. ***NI*** Impacts would be similar to Alternative A.	Compatibility with Current and Future Use ***LSI*** The land use density would increase on-base with a decrease in open space. There would be more of an impact within the installation boundary than other alternatives but there would be a less than significant impact on the adjacent community, similar to Alternative A. ***LSI*** The long-term impact of the existing noise levels at AAFB on the proposed housing would be less than significant.	Compatibility with Current and Future Use ***LSI*** Impacts would be similar to Alternative A. ***NI*** Impacts would be similar to Alternative A.	Compatibility with Current and Future Use ***LSI*** Impacts would be similar to Alternative A. ***LSI*** Impacts would be similar to Alternative C.	Compatibility with Current and Future Use ***LSI*** Impacts would be similar to Alternative A. ***NI*** Impacts would be similar to Alternative A.
RECREATIONAL RESOURCES					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
LSI Short-term slowed access to recreational resources during the construction phase with use of public roads by construction vehicles.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
LSI Considerably smaller number of Marines and dependents representing recreational users. Direct impacts from long-term increase in user demand of recreational resources and accelerated deterioration of resources. Impacts would be less than Alternative D (which has the greatest impact).	***LSI*** Impacts would be similar to Alternative A, except there would also be impacts to Latte Stone Park. Impacts would be less than Alternative D (which has the greatest impact).	***LSI*** Impacts would be similar to Alternative A.	***SI*** Direct impacts from removal of Eagle Field from public use could result in a long-term significant impact to recreational resources in central Guam. ***Potential Mitigation Measures*** **Mitigation measures have not been identified at this time.**	***LSI*** Impacts would be similar to Alternative A.	***SI-M*** Reduction of recreational opportunities off-base due to the increase in the number of users. Accelerated deterioration of resources. Diminished user satisfaction due to reduced recreational opportunities. Conflicts between users and uses. ***Potential Mitigation Measures*** **GovGuam to update Guam Comprehensive Outdoor Recreation Plan that addresses recreational user use, demand, preference, conflicts, and conditions. (This measure would fall within GovGuam authority to implement).** **Collaborate with the GDAWR to establish outreach programs and docent (person who leads guided tours) programs for the five marine preserves and other environmentally sensitive areas on Guam.** **Provide for improvements and maintenance of federally owned portions of Tanguisson Beach, along with the management of the coastline to the north of Hilaan that contains significant natural, cultural, scenic, and recreational resources.**
TERRESTRIAL BIOLOGICAL RESOURCES					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Vegetation	Vegetation	Vegetation	Vegetation	Vegetation	Vegetation
SI-M Conversion of 1,007 acres (408 ha) of limestone forest to developed area. ***Potential Mitigation Measures*** **Forest enhancement on a minimum of 1,007 acres (408 ha) of limestone forest.**	***SI-M*** Conversion of 815 acres (330 ha) of limestone forest to developed area. ***Potential Mitigation Measures*** **Forest enhancement on a minimum of 815 acres (330 ha) of limestone forest.**	***SI-M*** Conversion of 1,177 acres (476 ha) of limestone forest to developed area. ***Potential Mitigation Measures*** **Forest enhancement on a minimum of 1,177 acres (476 ha) of limestone forest.**	***SI-M*** Conversion of 231 acres (94 ha) of limestone forest to developed area. ***Potential Mitigation Measures*** **Forest enhancement on a minimum of 231 acres (94 ha) of limestone forest.**	***SI-M*** Conversion of 780 acres (316 ha) of limestone forest to developed area. ***Potential Mitigation Measures*** **Forest enhancement on a minimum of 780 acres (316 ha) of limestone forest.**	***SI-M*** Conversion of 1,336 acres (541 ha) of limestone forest to developed area. ***Potential Mitigation Measures*** **See the 2010 Final EIS, Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Table 2.2-1: Summary of Proposed Mitigation Measures (mitigations specific to Volume 2), Pages 2-25-2-45.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Terrestrial Conservation Areas ***SI-M*** Conversion of 1,243 acres (503 ha) of Overlay Refuge lands to developed area. ***Potential Mitigation Measures*** • **Submit a proposal to designate an ERA on NAVMAG.** • **Submit a proposal for the expansion of Orote Peninsula ERA.** ***NI*** Haputo ERA - Haputo ERA would not be directly impacted; use of Haputo ERA would not increase as a result of construction activities.	Terrestrial Conservation Areas ***SI-M*** Conversion of 947 acres (383 ha) of Overlay Refuge lands to developed area. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.** ***NI*** Haputo ERA - Haputo ERA would not be directly impacted; use of Haputo ERA would not increase as a result of construction activities.	Terrestrial Conservation Areas ***SI-M*** Conversion of 894 acres (362 ha) of Overlay Refuge lands to developed area. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Terrestrial Conservation Areas ***LSI*** Conversion of 48 acres (19 ha) of Overlay Refuge lands to developed area within the support areas.	Terrestrial Conservation Areas ***SI-M*** Conversion of 1,065 acres (431 ha) of Overlay Refuge lands to developed area. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.** ***NI*** Haputo ERA - Haputo ERA would not be directly impacted; use of Haputo ERA would not increase as a result of construction activities.	Terrestrial Conservation Areas ***SI-M*** Conversion of 1,129 acres (453 ha) of Overlay Refuge lands to developed area. ***Potential Mitigation Measures*** **See the 2010 Final EIS, Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Table 2.2-1: Summary of Proposed Mitigation Measures (mitigations specific to Volume 2), Pages 2-25-2-45.**
Native Wildlife ***LSI*** Direct impacts to 1,160 acres (469 ha) of potential wildlife habitat. Wildlife currently present is either widespread on Guam or prefers open spaces, which would not be reduced. With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during proposed construction activities is considered unlikely.	Native Wildlife ***LSI*** No additional impacts to native wildlife species from construction beyond those described for Alternative A would occur under Alternative B. Wildlife currently present is either widespread on Guam or prefers open spaces, which would not be reduced. With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during the proposed construction activities is considered unlikely.	Native Wildlife ***LSI*** Direct impacts to 1,266 acres (512 ha) of potential wildlife habitat. Wildlife currently present is either widespread on Guam or prefers open spaces, which would not be reduced. With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during the proposed short-term construction activities is considered unlikely.	Native Wildlife ***LSI*** Direct impacts to 991 acres (401 ha) of potential wildlife habitat. Wildlife currently present is either widespread on Guam or prefers open spaces, which would not be reduced. With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during the proposed short-term construction activities is considered unlikely.	Native Wildlife ***LSI*** Direct impacts to 912 acres (369 ha) of potential wildlife habitat. Wildlife currently present is either widespread on Guam or prefers open spaces, which would not be reduced. With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during proposed construction activities is considered unlikely.	Native Wildlife ***LSI*** Direct impacts to 1,611 acres (652 ha) of potential wildlife habitat. Wildlife currently present is either widespread on Guam or prefers open spaces, which would not be reduced. With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during the proposed short-term construction activities is considered unlikely.
Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat - impacts to 957 acres (387 ha) of fruit bat recovery habitat. Mariana crow - impacts to 957 acres (387 ha) of crow recovery habitat. Guam rail - impacts to 500 acres (202 ha) of rail recovery habitat. Guam Micronesian kingfisher - impacts to 957 acres (387 ha) of kingfisher recovery habitat. *Serianthes* tree - impacts to 634 acres (257 ha) of *Serianthes* recovery habitat. ***Potential Mitigation Measures*** • **Implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit these species.** • **Brown treesnake research and suppression.**	Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat - impacts to 754 acres (305 ha) of fruit bat recovery habitat. Mariana crow - impacts to 754 acres (305 ha) of crow recovery habitat. Guam rail - impacts to 571 acres (231 ha) of rail recovery habitat. Guam Micronesian kingfisher - impacts to 754 acres (305 ha) of kingfisher recovery habitat. *Serianthes* tree - impacts to 619 acres (250 ha) of *Serianthes* recovery habitat. ***Potential Mitigation Measures*** • **Implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit these species.** • **Brown treesnake research and suppression.**	Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat - impacts to 1,159 acres (469 ha) of fruit bat recovery habitat. Mariana crow - impacts to 1,162 acres (470 ha) of crow recovery habitat. Guam rail - impacts to 228 acres (92 ha) of rail recovery habitat. Guam Micronesian kingfisher - impacts to 1,159 acres (469 ha) of kingfisher recovery habitat. *Serianthes* tree - impacts to 1,093 acres (442 ha) of *Serianthes* recovery habitat. ***Potential Mitigation Measures*** • **Implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit these species.** • **Brown treesnake research and suppression.**	Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Guam rail - impacts to 864 acres (350 ha) of rail recovery habitat. Guam tree snail - impacts to 266 acres (107 ha) of limestone forest. ***Potential Mitigation Measures*** • **Implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit these species.** • **Brown treesnake research and suppression.**	Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat - impacts to 719 acres (291 ha) of fruit bat recovery habitat. Mariana crow - impacts to 719 acres (291 ha) of crow recovery habitat. Guam rail - impacts to 507 acres (205 ha) of rail recovery habitat. Guam Micronesian kingfisher - impacts to 719 acres (291 ha) of kingfisher recovery habitat. *Serianthes* tree - impacts to 648 acres (262 ha) of *Serianthes* recovery habitat. ***Potential Mitigation Measures*** • **Implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit these species.** • **Brown treesnake research and suppression.**	Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat - impacts to 1,248 acres (505 ha) of fruit bat recovery habitat. Mariana crow - impacts to 1,248 acres (505 ha) of crow recovery habitat. Guam rail - impacts to 654 acres (265 ha) of rail recovery habitat. Guam Micronesian kingfisher - impacts to 1,248 acres (505 ha) of kingfisher recovery habitat. *Serianthes* tree - impacts to 358 acres (144 ha) of *Serianthes* recovery habitat. ***Potential Mitigation Measures*** **See the 2010 Final EIS, Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Table 2.2-1: Summary of Proposed Mitigation Measures (mitigations specific to Volume 2), Pages 2-25-2-45.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
LSI Sea turtles and ESA proposed species - implementation of BMPs would avoid and minimize impacts to ESA proposed species; implementation of BMPs (e.g., shielded lights) would avoid and minimize impacts to coastal areas and sea turtles. ***NI*** Tree snails -located only within Haputo ERA which would not be impacted.	***LSI*** Sea turtles and ESA proposed species - implementation of BMPs would avoid and minimize impacts to ESA proposed species; implementation of BMPs (e.g., shielded lights) would avoid and minimize impacts to coastal areas and sea turtles. ***NI*** Tree snails - located only within Haputo ERA which would not be impacted.	***LSI*** Sea turtles and ESA proposed species - implementation of BMPs would avoid and minimize impacts to ESA proposed species; implementation of BMPs (e.g., shielded lights) would avoid and minimize impacts to coastal areas and sea turtles.	***LSI*** Mariana fruit bat - impacts to 48 acres (19 ha) of fruit bat recovery habitat. Mariana crow - impacts to 48 acres (19 ha) of crow recovery habitat. Guam Micronesian kingfisher - impacts to 48 acres (19 ha) of kingfisher recovery habitat. *Serianthes* tree - impacts to 41 acres (17 ha) of *Serianthes* recovery habitat. Mariana common moorhen - loss of golf course pond previously used by moorhen would be less than significant impact. ESA proposed species - implementation of BMPs would avoid and minimize impacts to ESA proposed species.	***LSI*** Sea turtles and ESA proposed species - implementation of BMPs would avoid and minimize impacts to ESA proposed species; implementation of BMPs (e.g., shielded lights) would avoid and minimize impacts to coastal areas and sea turtles. ***NI*** Tree snails - located only within Haputo ERA which would not be impacted.	***LSI*** Mariana eight-spot butterfly - butterflies or host plants not found in impacted areas; implementation of BMPs would avoid and minimize impacts to butterflies, host plants, and sea turtles. ***NI*** Tree snails -located only within Haputo ERA which would not be impacted.
Special-Status Species - Guam-Listed and SOGCN	Special-Status Species - Guam-Listed and SOGCN	Special-Status Species - Guam-Listed and SOGCN	Special-Status Species - Guam-Listed and SOGCN	Special-Status Species - Guam-Listed and SOGCN	Special-Status Species - Guam-Listed and SOGCN
SI-M Impacts and mitigations associated with Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***SI-M*** Moth skink and Pacific slender-toed gecko – loss of 1,007 acres (408 ha) of occupied habitat. ***Potential Mitigation Measures*** **Implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit these species.**	***SI-M*** Impacts and mitigations associated with Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***SI-M*** Moth skink and Pacific slender-toed gecko – loss of 815 acres (330 ha) of occupied habitat. ***Potential Mitigation Measures*** **Implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit these species.**	***SI-M*** Impacts and mitigations associated with Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***LSI*** Micronesian starling - temporary loss of a portion of existing urban habitat. Moth skink - known occurrence only within proposed AAFB utility corridor.	***SI-M*** Impacts and mitigations associated with Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***LSI*** Moth skink - species does not occur within Barrigada; known occurrence only within proposed AAFB utility corridor.	***SI-M*** Impacts and mitigations associated with Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***SI-M*** Moth skink and Pacific slender-toed gecko – loss of 780 acres (316 ha) of occupied habitat. ***Potential Mitigation Measures*** **Implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit these species.**	***SI-M*** Impacts and mitigations associated with Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***SI-M*** Moth skink and Pacific slender-toed gecko – loss of 1,336 acres (541 ha) of occupied habitat. ***Potential Mitigation Measures*** **See the 2010 Final EIS, Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Table 2.2-1: Summary of Proposed Mitigation Measures (mitigations specific to Volume 2), Pages 2-25-2-45.**
NI Micronesian starling, white-throated ground dove - species are very rarely recorded within project areas.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Micronesian starling - species does not occur in project areas.	***LSI*** Micronesian starling - temporary loss of portion of existing urban habitat. Moth skink - known occurrence only within proposed AAFB utility corridor. ***NI*** White-throated ground dove - species does not occur within project areas.	***NI*** Micronesian starling, white-throated ground dove - species do not occur within project areas.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Vegetation ***LSI*** With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during operations of cantonment/ housing area is considered unlikely.	Vegetation ***LSI*** Impacts would be similar to Alternative A.	Vegetation ***LSI*** Impacts would be similar to Alternative A.	Vegetation ***LSI*** Impacts would be similar to Alternative A.	Vegetation ***LSI*** Impacts would be similar to Alternative A.	Vegetation ***LSI*** Impacts would be similar to Alternative A.
Terrestrial Conservation Areas ***SI-M*** Haputo ERA - potential increased usage by military and civilian personnel. ***Potential Mitigation Measures*** • **Fencing.** • **Info/educational signage.** • **Educational materials regarding sensitive biological resources.** • **Monitoring of visitor use.**	Terrestrial Conservation Areas ***SI-M*** Haputo ERA - potential increased usage by military and civilian personnel. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Terrestrial Conservation Areas	Terrestrial Conservation Areas	Terrestrial Conservation Areas ***SI-M*** Haputo ERA - potential increased usage by military and civilian personnel. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Terrestrial Conservation Areas ***LSI*** Although Overlay Refuge-specific BMPs were not identified within the 2010 Final EIS, BMPs proposed for other terrestrial biological resources would be applicable and relevant to avoid and minimize impacts to Overlay Refuge lands.
NI Overlay Refuge - with implementation of BMPs, there would be no impacts to Overlay Refuge from operations.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** No terrestrial conservation areas within Barrigada.	***NI*** Impacts would be similar to Alternative A.	
Native Wildlife ***LSI*** With implementation of BMPs, potential impacts to wildlife from operations would be reduced to less than significant.	Native Wildlife ***LSI*** Impacts would be similar to Alternative A.	Native Wildlife ***LSI*** Impacts would be similar to Alternative A.	Native Wildlife ***LSI*** Impacts would be similar to Alternative A.	Native Wildlife ***LSI*** Impacts would be similar to Alternative A.	Native Wildlife ***LSI*** Impacts would be similar to Alternative A.
Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat - impacts to fruit bat habitat due to operations (e.g., lights, noise, human activity). ***Potential Mitigation Measures*** • **Haputo ERA - fencing, info/educational signage, educational materials regarding sensitive biological resources, and monitoring of visitor use.** • **Continued implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit the Mariana fruit bat.**	Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat - impacts to fruit bat habitat due to operations (e.g., lights, noise, human activity). ***Potential Mitigation Measures*** • **Haputo ERA - fencing, info/educational signage, educational materials regarding sensitive biological resources, and monitoring of visitor use.** • **Continued implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit the Mariana fruit bat.**	Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat - impacts to fruit bat habitat due to operations (e.g., lights, noise, human activity). ***Potential Mitigation Measures*** **Continued implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit the Mariana fruit bat.**	Special-Status Species – Federal ESA-Listed and Proposed Species	Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat - impacts to fruit bat habitat due to operations (e.g., lights, noise, human activity). ***Potential Mitigation Measures*** • **Haputo ERA - fencing, info/educational signage, educational materials regarding sensitive biological resources, and monitoring of visitor use.** • **Continued implementation of the potential mitigation measures under Construction Impacts, Vegetation would also benefit the Mariana fruit bat.**	Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat. Mariana crow, Guam Micronesian kingfisher, Guam rail - impacts to habitat due to operations (e.g., lights, noise, human activity). ***Potential Mitigation Measures*** **See the 2010 Final EIS, Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Table 2.2-1: Summary of Proposed Mitigation Measures (mitigations specific to Volume 2), Pages 2-25-2-45.**
NI Mariana Crow, Guam Rail, and Guam Micronesian Kingfisher - no impacts as these species no longer occur in the wild on Guam. ***LSI*** Sea turtles - implementation of BMPs (e.g., shielded lights) would avoid and minimize impacts to coastal areas; implementation of potential mitigation measures for Vegetation and Terrestrial Conservation Areas would also benefit sea turtles.	***NI*** Mariana Crow, Guam Rail, and Guam Micronesian Kingfisher - no impacts as these species no longer occur in the wild on Guam. ***LSI*** Impacts would be similar to Alternative A.	***NI*** Mariana Crow, Guam Rail, and Guam Micronesian Kingfisher - no impacts as these species no longer occur in the wild on Guam. ***LSI*** Sea turtles - suitable beach habitat not within impacted areas; implementation of BMPs (e.g., shielded lights) would avoid and minimize impacts to coastal areas.	***NI*** Mariana Crow, Guam Rail, and Guam Micronesian Kingfisher - no impacts as these species no longer occur in the wild on Guam.	***NI*** Mariana Crow, Guam Rail, and Guam Micronesian Kingfisher - no impacts as these species no longer occur in the wild on Guam. ***LSI*** Impacts would be similar to Alternative A.	***LSI*** Sea turtles, tree snails - species only found within Haputo ERA; implementation of potential mitigation measures for fruit bat would benefit sea turtles and tree snails.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
NI ESA-proposed species - cantonment/housing operations would not impact ESA-proposed species. *Serianthes* tree - no operational impacts to Serianthes or recovery habitat due to cantonment/housing operations.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Mariana common moorhen, Guam tree snail -, no suitable habitat would occur within Barrigada after construction.	***NI*** Impacts would be similar to Alternative A.	***NI*** Mariana eight-spot butterfly - cantonment/housing operations would not impact butterflies or host plants. *Serianthes* tree - no operational impacts to Serianthes or recovery habitat due to cantonment/housing operations.
Special-Status Species - Guam-Listed and SOGCN Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***NI*** Micronesian starling, white-throated ground dove - species do not occur within project area. Moth skink, Pacific slender-toed gecko - cantonment/housing operations would not impact these species.	Special-Status Species - Guam-Listed and SOGCN Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***NI*** Impacts would be similar to Alternative A.	Special-Status Species - Guam-Listed and SOGCN Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***NI*** Micronesian starling, moth skink - cantonment/housing operations would not impact these species. White-throated ground dove - species does not occur within project area.	Special-Status Species - Guam-Listed and SOGCN Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***NI*** Micronesian starling, moth skink - cantonment/housing operations would not impact these species.	Special-Status Species - Guam-Listed and SOGCN Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***NI*** Micronesian starling, moth skink - cantonment/housing operations would not impact these species. White-throated ground dove - species does not occur within project area.	Special-Status Species - Guam-Listed and SOGCN Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***NI*** Moth skink, Pacific slender-toed gecko, - cantonment/housing operations would not impact these species.
MARINE BIOLOGICAL RESOURCES					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Marine Flora and Invertebrates ***SI*** Increasing wastewater discharge from a non-compliant treatment plant would result in significant and unmitigable indirect impacts to marine flora and invertebrates during the period of non-compliance. Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate the significant indirect impacts once the upgrades are completed. Until the WWTP upgrades are completed (anticipated to be early in the operational phase of the proposed action) there would be an indirect and unmitigable significant impact to nearshore waters during construction.	Marine Flora and Invertebrates ***SI*** Impacts would be similar to Alternative A.	Marine Flora and Invertebrates ***SI*** Impacts would be similar to Alternative A.	Marine Flora and Invertebrates ***SI*** Impacts would be similar to Alternative A	Marine Flora and Invertebrates ***SI*** Impacts would be similar to Alternative A.	Marine Flora and Invertebrates ***SI*** Impacts would be similar to Alternative A.
LSI Potential indirect impacts on marine flora and invertebrates may occur from increased recreational use (damage to reefs typically caused by anchors, reef-walkers, or reckless scuba diving, snorkeling, and fishing activities) by the construction workforce, but are avoided or minimized to less than significant impacts with the implementation of BMPs.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impact.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impact.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since the Finegayan cantonment would be developed further from the coast, thus minimizing impacts.	***LSI*** While less than significant impacts to marine flora and invertebrates would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4, due to the larger proposed footprint and number of the Marines and dependents that would arrive on Guam under the No-Action Alternative, impacts would be of greater intensity than those for the proposed action in this SEIS.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Fish	Fish	Fish	Fish	Fish	Fish
SI Increasing wastewater discharge from a non-compliant treatment plant would result in significant and unmitigable indirect impacts to fish during the period of non-compliance. Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate the significant indirect impacts once the upgrades are completed. Until the WWTP upgrades are completed (anticipated to be early in the operational phase of the proposed action) there would be an indirect and unmitigable significant impact to nearshore waters during construction.	***SI*** Impacts would be similar to Alternative A.	***SI*** Impacts would be similar to Alternative A.	***SI*** Impacts would be similar to Alternative A	***SI*** Impacts would be similar to Alternative A.	***SI*** Impacts would be similar to Alternative A.
LSI Potential indirect impacts on fish may occur from increased recreational use as mentioned above, but are avoided or minimized to less than significant impacts with the implementation of BMPs.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impact.	***LSI*** Impacts would be similar to Alternative A. In addition, AAFB permits hook and line fishing and swimming at designated locations, which reduce potential impact.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impact.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since the Finegayan cantonment would be developed further from the coast, thus minimizing impact. In addition, AAFB permits hook and line fishing and swimming at designated locations, which reduce potential impacts.	***LSI*** While less than significant impacts to fish would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4, due to the larger proposed footprint and number of the Marines and dependents that would arrive on Guam under the No-Action Alternative, impacts would be of greater intensity than those for the proposed action in this SEIS.
Essential Fish Habitat	Essential Fish Habitat	Essential Fish Habitat	Essential Fish Habitat	Essential Fish Habitat	Essential Fish Habitat
SI Increasing wastewater discharge from a non-compliant treatment plant could result in significant and unmitigable indirect impacts to essential fish habitat during the period of non-compliance. Upgrading the Northern District WWTP treatment systems (as required by the 2013 NPDES permit) would mitigate the significant indirect impacts once the upgrades are completed. Until the WWTP upgrades are completed (anticipated to be early in the operational phase of the proposed action) there would be an indirect and unmitigable significant impact to nearshore waters during construction.	***SI*** Impacts would be similar to Alternative A.	***SI*** Impacts would be similar to Alternative A.	***SI*** Impacts would be similar to Alternative A	***SI*** Impacts would be similar to Alternative A.	***SI*** Impacts would be similar to Alternative A.
LSI Potential indirect impacts on essential fish habitat may occur from increased recreational use as mentioned above, but are avoided or minimized to less than significant impacts with the implementation of BMPs.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impact.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impact.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since the Finegayan cantonment would be developed further from the coast, thus minimizing impacts.	***LSI*** While less than significant impacts to EFH would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4, due to the larger proposed footprint and number of the Marines and dependents that would arrive on Guam under the No-Action Alternative, impacts would be of greater intensity than those for the proposed action in this SEIS.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** Potential short-term impact to the green sea turtle from disturbance resulting from increased activity in the area. Potential indirect impact on special-status species from increased recreational use as mentioned above, but are avoided or minimized to less than significant impacts with the implementation of BMPs.	Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impact.	Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** Impacts would be similar to Alternative A.	Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** Impacts would be similar to Alternative A, except reduced since housing would be developed further from the coast where special-status species would not be expected to be affected by construction activities, only increased recreational use of marine biological resources.	Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since the Finegayan cantonment would be developed further from the coast, thus minimizing impacts.	Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** While less than significant impacts to special-status species would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4, due to the larger proposed footprint and number of the Marines and dependents that would arrive on Guam under the No-Action Alternative, impacts would be of greater intensity than those for the proposed action in this SEIS.
Marine Conservation Areas ***NI*** With implementation of access restrictions for construction personnel, use of Haputo ERA is not expected to increase as a result of the construction workforce. Therefore, no direct or indirect impacts to marine conservation areas are expected.	Marine Conservation Areas ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impact.	Marine Conservation Areas ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impact.	Marine Conservation Areas ***NI*** There are no anticipated impacts to marine conservation areas as a result of the construction of Alternative D.	Marine Conservation Areas ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since the Finegayan cantonment would be developed further from the coast, thus minimizing impacts.	Marine Conservation Areas ***LSI*** While less than significant impacts to Marine Conservation Areas would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4, due to the larger proposed footprint and number of the Marines and dependents that would arrive on Guam under the No-Action Alternative, impacts would be of greater intensity than those for the proposed action in this SEIS.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Marine Flora and Invertebrates ***SI-M*** Increasing wastewater discharge from a non-compliant treatment plant could result in significant indirect impacts to marine flora and invertebrates during the period of non-compliance. ***Potential Mitigation Measures*** **Upgrading the Northern District WWTP to secondary treatment standards and Guam Water Quality Standards, including those for nutrients (as required by the 2013 NPDES permit), would mitigate significant impacts to marine biological resources. The FY 2014 NDAA requires the EAC to develop an implementation plan that addresses assistance to public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. The water and wastewater assessment that DoD prepared to support the Implementation Plan recommends upgrades to the Northern District WWTP and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public**	Marine Flora and Invertebrates ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Marine Flora and Invertebrates ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Marine Flora and Invertebrates ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A but would include recommended upgrades of both the Agaña WWTP and Northern District WWTPs.**	Marine Flora and Invertebrates ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Marine Flora and Invertebrates ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as Alternative A.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended. ***LSI*** Potential indirect impacts to marine flora and invertebrates may occur from increased recreational use, as described above for construction impacts, but are avoided or minimized to less than significant impacts with the implementation of BMPs. ***NI*** No impact from stormwater, sedimentation, or non-point source pollution.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impact.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A; however, potential increased recreational use of marine biological resources would likely be lower in intensity but more widespread given this alternative's location is further from the coast.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since the Finegayan cantonment would be developed further from the coast, thus minimizing impacts.	***LSI*** While less than significant impacts to marine flora and invertebrates would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4, due to the larger proposed footprint and number of the Marines and dependents that would arrive on Guam under the No-Action Alternative, impacts would be of greater intensity than those for the proposed action in this SEIS.
Fish ***SI-M*** Increasing wastewater discharge from a non-compliant treatment plant could result in significant indirect impacts to fish during the period of non-compliance. ***Potential Mitigation Measures*** **Upgrading the Northern District WWTP to secondary treatment standards (as required by the 2013 NPDES permit) would mitigate significant impacts to marine biological resources. The FY 2014 NDAA requires the EAC to develop an implementation plan that addresses assistance to public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. The water and wastewater assessment that DoD prepared to support the Implementation Plan recommends upgrades to the Northern District WWTP and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.**	Fish ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Fish ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Fish ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A but would include recommended upgrades of both the Agaña WWTP and Northern District WWTPs.**	Fish ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Fish ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as Alternative A.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
LSI Potential indirect impacts to fish may occur from increased recreational use as mentioned above, but are avoided or minimized to less than significant impacts with the implementation of BMPs. ***NI*** No impact from stormwater, sedimentation, or non-point source pollution.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impacts.	***LSI*** Impacts would be similar to Alternative A. In addition, AAFB fishing and swimming regulations would minimize impacts.	***LSI*** Impacts would be similar to Alternative A, except lower in intensity but more widespread given this alternative's location is further from the coast.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since the Finegayan cantonment would be developed further from the coast, thus minimizing impacts.	***LSI*** While less than significant impacts to fish would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4, due to the larger proposed footprint and number of Marines and dependents that would arrive on Guam under the No-Action Alternative, impacts would be of greater intensity than those for the proposed action in this SEIS.
Essential Fish Habitat ***SI-M*** Increasing wastewater discharge from a non-compliant treatment plant could result in significant indirect impacts to essential fish habitat during the period of non-compliance. ***Potential Mitigation Measures*** **Upgrading the Northern District WWTP to secondary treatment standards (as required by the 2013 NPDES permit) would mitigate significant impacts to marine biological resources. The FY 2014 NDAA requires the EAC to develop an implementation plan that addresses assistance to public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including improvements and upgrades to the Guam wastewater system. The water and wastewater assessment that DoD prepared to support the Implementation Plan recommends upgrades to the Northern District WWTP and the refurbishment of the GWA interceptor sewer from AAFB to the Northern District WWTP. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.**	Essential Fish Habitat ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Essential Fish Habitat ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Essential Fish Habitat ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A but would include recommended upgrades of both the Agaña WWTP and Northern District WWTPs.**	Essential Fish Habitat ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Essential Fish Habitat ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as Alternative A.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
LSI During the interim period of change when the effluent discharged from the Northern District WWTP would not meet Guam Water Quality Standards, the proposed action may adversely affect EFH, but effects would be temporary and less than significant. Potential indirect impacts to EFH may occur from increased recreational use, as described above for construction impacts, but would be avoided or minimized to less than significant impacts with the implementation of BMPs. ***NI*** No impact from stormwater, sedimentation, or non-point source pollution.	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impact.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A, except lower in intensity but more widespread given this alternative's location is further from the coast	***LSI*** Impacts would be similar to Alternative A, except slightly reduced since the Finegayan cantonment would be developed further from the coast, thus minimizing impacts.	***LSI*** While less than significant impacts to EFH would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4, due to the larger proposed footprint and number of the Marines and dependents that would arrive on Guam under the No-Action Alternative, impacts would be of greater intensity than those for the proposed action in this SEIS.
Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** Potential indirect impacts to the green sea turtle and hawksbill sea turtle may occur from increased recreational use, as described above for construction impacts, but are avoided or minimized to less than significant impacts with the implementation of BMPs. ***NI*** No impact from stormwater, sedimentation, or non-point source pollution.	Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impacts.	Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impacts.	Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impacts.	Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impacts.	Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** While less than significant impacts to special-status species would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4, due to the larger proposed footprint and number of the Marines and dependents that would arrive on Guam under the No-Action Alternative, impacts would be of greater intensity than those for the proposed action in this SEIS.
Marine Conservation Areas ***LSI*** With the implementation of BMPs, direct and indirect impacts associated with operational activities for the proposed action are expected to result in less than significant direct and indirect impacts to conservation efforts and management activities at the Haputo ERA, AAFB Marine Resource Preserve, the Pati Point Marine Preserve, and the submerged lands bordering the Guam NWR at Ritidian Point.	Marine Conservation Areas ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impacts.	Marine Conservation Areas ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impacts.	Marine Conservation Areas ***NI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impacts.	Marine Conservation Areas ***LSI*** Impacts would be similar to Alternative A, except slightly reduced since housing would be developed further from the coast, thus minimizing impacts.	Marine Conservation Areas ***LSI*** While less than significant impacts to Marine Conservation Areas would occur for both the No-Action Alternative and the action alternatives discussed in Chapter 4, due to the larger proposed footprint and number of the Marines and dependents that would arrive on Guam under the No-Action Alternative, impacts would be of greater intensity than those for the proposed action in this SEIS.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	*Fineqayan/South Fineqayan (Alternative B)*	*Andersen Air Force Base (Alternative C)*	*Barrigada (Alternative D)*	*Fineqayan/Andersen Air Force Base (Alternative E)*	*No-Action Alternative*
CULTURAL RESOURCES					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
SI-M Potential direct adverse effects to 21 historic properties, including 11 historic properties within the cantonment and housing area and undetermined effects to 7 unevaluated buildings. Potential impacts to culturally important natural resources from vegetation removal. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA processes, including data recovery and contractor measures, and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners.**	***SI-M*** Potential direct adverse effects to 18 historic properties including 8 historic properties within the cantonment and housing area. and undetermined effects to 7 unevaluated buildings. Potential impacts to culturally important natural resources from vegetation removal. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA processes, including data recovery and contractor measures, and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners.**	***SI-M*** Potential direct adverse effects to 17 historic properties including 7 historic properties within the cantonment and housing area and undetermined effects to 12 unevaluated buildings. Potential impacts to culturally important natural resources from vegetation removal. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA processes, including data recovery and contractor measures, and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners.**	***SI-M*** Potential direct adverse effects to 10 historic properties (none within the cantonment and housing area) and undetermined effects to 13 unevaluated archaeological locations and 8 unevaluated buildings. Potential impacts to culturally important natural resources from vegetation removal. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA processes, including data recovery and contractor measures, and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners.**	***SI-M*** Potential direct adverse effects to 17 historic properties, including 7 historic properties within the cantonment and housing areas. Undetermined effects to 14 unevaluated buildings. Potential impacts to culturally important natural resources from vegetation removal. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA processes, including data recovery and contractor measures, and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners.**	***SI-M*** Direct adverse effects to 12 historic properties within the cantonment and housing areas. The total number of historic properties affected does not include off-site utilities such as the well development area. Potential impacts to culturally important natural resources from vegetation removal. ***Potential Mitigation Measures*** **Mitigation through the 2011 PA with data recovery and public interpretation, and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners.**
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
SI-M Potential indirect adverse effects to one NRHP-eligible archaeological site/potential traditional cultural property due to increased recreation use. ***Potential Mitigation Measures*** **Proposed mitigation through the 2011 PA stipulation on Cultural Resources Awareness orientation**.	***SI-M*** Potential indirect adverse effects to two NRHP-eligible archaeological sites/potential traditional cultural properties due to increase in recreation use. ***Potential Mitigation Measures*** **Proposed mitigation through the 2011 PA stipulation on Cultural Resources Awareness orientation and educational signage.**	***NI*** No effects to historic properties from operations.	***NI*** No effects to historic properties from operations.	***NI*** No effects to historic properties from operations.	***SI-M*** Potential indirect adverse effects to two NRHP-eligible archaeological sites/potential Traditional Cultural Properties due to increased recreation use. ***Potential Mitigation Measures*** **Proposed mitigation through the 2011 PA stipulation on Cultural Resources Awareness orientation.**
VISUAL RESOURCES					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
LSI Short-term direct impacts from presence of construction equipment.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
LSI The Finegayan site is already partially developed and the reduced number of Marines and dependents coming to Guam would result in less development than that proposed in the 2010 Final EIS. Long-term direct impacts from features being publicly visible from roadways, however, no recognized view corridors or sensitive receptors would be impacted.	***LSI*** Long-term, direct impacts from some features being visible to public (e.g., gates, fencing, landscaping). New base features would be consistent with 2011 IAP.	***LSI*** The proposed development at AAFB differs substantially from that proposed and approved under the 2010 Final EIS. Long-term direct impact from more urban development related to the cantonment/family housing. Impacts would be less than significant due to the dominant presence of vegetation throughout the region.	***LSI*** Direct impacts to the visual element in the long-term, but less than significant, since the visual character of the base would not be drastically altered. Usual characteristics would be altered to a more urban appearance.	***LSI*** Impacts would be similar to Alternatives A and C.	***SI-M*** The mostly vegetated former FAA parcel and relatively open characteristic of the southern half of Finegayan and South Finegayan would be completely developed. This would represent a major change over the existing visual conditions. However, most of the property is already under DoD ownership, and there are few, if any, sensitive views or receptors that currently exist. ***Potential Mitigation Measures*** **Prepare Installation Appearance Plan and implement design guidelines for all buildings.** **Minimize impact by using native flora to create a natural-appearing "screen" around the cleared range areas, outside of the firebreaks/perimeter roads.** **Develop and implement a landscape plan focused on retention of mature specimen trees during construction (where possible)**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
					and the establishment of a full suite of vegetation representing Guam's native flora.
GROUND TRANSPORTATION					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
LSI Short-term, direct impacts from construction workers and construction-related vehicle trips resulting in congestion on on-base roadways. Implementation of appropriate work zone traffic management strategies and BMPs would minimize impacts.	***LSI*** Impacts would be similar to Alternative A. Under this alternative, there would be two separate contiguous development areas unlike Alternative A.	***LSI*** Impacts would be similar to Alternative A. Under this alternative, there would be two separate contiguous development areas unlike Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A. Under this alternative, there would be two separate contiguous development areas unlike Alternative A.	***LSI*** Impacts would be similar to Alternative A.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**		**Operation Impacts**
NI There would be no long-term direct impacts to on-base (internal) roadways or intersections, transit conditions, pedestrian and bicycle conditions, All on-base (internal) roadway segments and intersections have been designed with the capacity required to accommodate the expected travel demand.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***NI*** Impacts would be similar to Alternative A.	***LSI*** The impacts to ground transportation remain the same as those described in the 2010 Final EIS (Volume 6, Chapter 4: Roadways, Section 2.5.3.2: Alternative 2, page 2-151). Identified impacts would be less than significant through implementation of potential mitigation measures, specifically, the roadway improvements identified in the 2010 Final EIS (Volume 6, Chapter 4: Roadways, Section 2.5.1.7: Table 2.5-3. Guam Road Network Projects by Island Region, pages 2-140 through 2-144).
MARINE TRANSPORTATION					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
LSI Construction would result in an increase in vessel traffic that would cause a less than significant short-term, direct impact to port traffic and processing times.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
LSI Operation would result in an increase in vessel traffic that would cause a less than significant long-term, direct impact to port traffic and processing times.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.	***LSI*** Impacts would be similar to Alternative A.
UTILITIES					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Electrical Power ***LSI*** Potentially short-term power outages during construction of the expanded system could occur. Advance notice and other measures would minimize impacts.	Electrical Power ***LSI*** Impacts would be similar to Alternative A, except for the addition of an underground distribution cable from Finegayan to South Finegayan along Route 3 to provide power to the South Finegayan family housing area.	Electrical Power ***LSI*** Impacts would be similar to Alternative A. There could be short-term power outages during construction of the expanded system. Advance notice and other measures would minimize impacts.	Electrical Power ***LSI*** Impacts would be similar to Alternative A. There could be short-term power outages during construction of the expanded system. Advance notice and other measures would minimize impacts.	Electrical Power ***LSI*** Impacts would be similar to Alternative A. There could be short-term power outages during construction of the expanded system. Advance notice and other measures would minimize impacts.	Electrical Power ***LSI*** Reconditioning of existing combustion turbine generators would be required to support the construction phase and operations phase. Upgrades to off-base electrical transmission systems would also be required to support the No-Action Alternative, while no upgrades to existing generating facilities would be required under the proposed action alternatives where the total estimated increase in electrical demand would be about one-third that under the No-Action Alternative**.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Potable Water ***LSI*** Short-term impacts to DoD potable water system during water main replacement and/or system modifications. The replacement main would be installed adjacent to the existing mains and switched over in phases to minimize water service interruptions to current customers and existing storage tanks around Guam should be adequate to provide sufficient water to current customers during modifications. The proposed system would supplement any lost water production.	Potable Water ***LSI*** Impacts would be similar to Alternative A. Potentially short water outages during construction of the expanded and modified system could occur. Construction phasing, temporary water lines, customer notifications, off-hours construction work, or other potential mitigations would be utilized to mitigate outages.	Potable Water ***LSI*** Impacts would be similar to Alternative A. Potentially short water outages during construction of the expanded and modified system could occur. Construction phasing, temporary water lines, customer notifications, off-hours construction work, or other potential mitigations would be utilized to mitigate outages.	Potable Water ***LSI*** Impacts would be similar to Alternative A. Potentially short water outages during construction of the expanded and modified system could occur. Construction phasing, temporary water lines, customer notifications, off-hours construction work, or other potential mitigations would be utilized to mitigate outages.	Potable Water ***LSI*** Impacts would be similar to Alternative A. Potentially short water outages during construction of the expanded and modified system could occur. Construction phasing, temporary water lines, customer notifications, off-hours construction work, or other potential mitigations would be utilized to mitigate outages.	Potable Water ***SI - GWA Distribution*** The GWA distribution system is plagued by high, unaccounted-for water, low pressure areas, leaks, and frequent outages and boil water notices. The construction force and induced population influx will put greater strain on this system's ability to deliver water to its customers. ***SI-M - GWA Supply and Transmission*** Impact to existing overburdened utilities infrastructure on Guam would be exacerbated by workforce and induced population. Projected potable water demand would not exceed sustainable yield of the NGLA. ***Potential Mitigation Measures*** **Mitigation would be the same as defined in the 2010 ROD.** ***LSI - NGLA*** The sustainable yield of the NGLA is adequate to provide required water during the construction period should adequate number of properly spaced wells be provided.
Wastewater ***SI*** Construction of the cantonment/family housing facilities under Alternative A would result in significant and unmitigable direct impacts during the period of non-compliance with the 2013 NPDES permit at the Northern District WWTP. ***Potential Mitigation Measures*** **Potential mitigation measures during construction would include constructing sewers during low flow periods, by-pass pumping, and having pump trucks on stand-by.** ***LSI*** Short-term, direct impact from potential service outages to current customers and sewage spills. Impacts minimized with BMPs.	Wastewater ***SI*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.** ***LSI*** Short-term, direct impact from potential service outages to current customers and sewage spills. Impacts minimized with BMPs.	Wastewater ***SI*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.** ***LSI*** Short-term, direct impact from potential service outages to current customers and sewage spills. Impacts minimized with BMPs.	Wastewater ***SI*** Impacts would be similar to Alternative A, except that impacts would affect both the Northern District WWTP and Agaña WWTP during the period of non-compliance with the NPDES permit. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.** ***LSI*** Short-term, direct impact from potential service outages to current customers and sewage spills. Impacts minimized with BMPs.	Wastewater ***SI*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.** ***LSI*** Short-term, direct impact from potential service outages to current customers and sewage spills. Impacts minimized with BMPs.	Wastewater ***SI*** Impacts would be similar to the action alternatives long-term direct impact because the Northern District WWTP currently would not be able to meet current treatment discharge limits. ***Potential Mitigation Measures*** **Mitigation would be the same as defined in the 2010 ROD.** ***LSI*** Wastewater (direct) DoD Apra Harbor WWTP treatment capacity. Wastewater (indirect) GWA Agaña WWTP treatment capacity. Wastewater (indirect) GWA Agaña WWTP effluent quality. Wastewater (indirect) GWA southern Guam WWTPs.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Solid Waste ***LSI*** The new Layon Landfill has the capacity to accommodate the projected MSW for the reduced levels of the current proposed action. The C&D debris that cannot be recycled or reused, and wastes that are prohibited at Layon Landfill would be disposed at the Naval Base Guam Landfill and permitted private hardfill facilities. All green waste would be processed for reuse. The DON is currently coordinating with the GEPA regarding the status of the permit for the Naval Base Guam Landfill. The proposed action would be consistent with solid waste permit terms and conditions.	Solid Waste ***LSI*** Impacts would be similar to Alternative A.	Solid Waste ***LSI*** Impacts would be similar to Alternative A, except that Alternative C would generate greater quantities of C&D waste due to the increased demolition of existing housing units at AAFB and the increased number of new units to be constructed.	Solid Waste ***LSI*** Impacts would be similar to Alternative A, except that Alternative D would generate greater quantities of C&D debris during construction	Solid Waste ***LSI*** Impacts would be similar to Alternative A, except that Alternative E would generate greater quantities of C&D waste due to the increased demolition of existing housing units at AAFB and the increased number of new units to be constructed.	Solid Waste ***LSI*** The quantities of solid wastes generated by the No-Action Alternative would be similar to that described in the 2010 Final EIS (Volume 6, Chapter 3) and would be substantially greater than that of the current proposed action.
IT/COMM ***LSI*** Short-term interruption to commercial service during rerouting of duct banks during construction. Commercial IT/COMM would need to be expanded into the proposed new development and would add users, presenting a minimal short-term, direct impact to current users.	IT/COMM ***LSI*** Impacts would be similar to Alternative A.	IT/COMM ***LSI*** Impacts would be similar to Alternative A. Minimal potential for short- or long-term adverse environmental consequences to the existing DoD IT/COMM facilities at AAFB. Direct impact from short-term lack of commercial service during the construction phase.	IT/COMM ***LSI*** Impacts would be similar to Alternative A. For the proposed housing area at Barrigada, there are several existing DoD IT/COMM lines, but no commercial lines. The proposed housing area has been designed around those existing lines using the best available information on their locations. It is possible that these lines could be impacted during construction. Should the locations of these existing lines be different from available information, the lines might require relocation or the proposed development might require revisions to avoid the existing lines.	IT/COMM ***LSI*** Short-term interruption to commercial service during rerouting of duct banks during construction. Commercial IT/COMM would need to be expanded into the proposed new development areas at both Finegayan (main cantonment) and AAFB (housing) and would add users, presenting a minimal short-term, direct impact to current users.	IT/COMM ***LSI*** Impacts would be similar to Alternative A. IT/COMM would have slightly more on base routings for the No-Action Alternative due to the increased size of the proposed cantonment/family housing.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Electrical Power ***LSI*** No long-term, directs impacts as electrical power distribution system has been developed to handle the increased demand from the proposed action and proposed improvements to electrical transmission systems would accommodate future demand. The island-wide electrical power generating system owned and operated by the GPA has adequate capacity to provide for the additional demands from the proposed action. With the proposed improvements to electrical transmission systems and measures to minimize outages during construction, long- and short-term direct impacts to the electrical systems would be less than significant.	Electrical Power ***LSI*** Impacts would be similar to Alternative A.	Electrical Power ***LSI*** Impacts would be similar to Alternative A.	Electrical Power ***LSI*** Impacts would be similar to Alternative A.	Electrical Power ***LSI*** Impacts would be similar to Alternative A.	Electrical Power ***LSI*** Off-base electrical transmission and generation systems would be upgraded to support the No-Action Alternative.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Potable Water ***SI-M (local) LSI (overall)*** ***NGLA Impact*** Short-term, localized significant impacts to the affected basin within the NGLA but less than significant impacts to the overall NGLA. Increased withdrawal from the NGLA may result in higher levels of chloride concentrations. The chloride concentration spikes could be a localized phenomenon, based on USGS modeling of NGLA. ***Potential Mitigation Measures*** **The DoD would, as appropriate, implement enhanced water conservation measures for the proposed action, improve existing DoD water systems to reduce system leaks, adjust pumping rates at DoD wells, use existing wells, and/or increase the use of surface water from Fena Reservoir to reduce withdrawals from the NGLA. The DoD would continue to support the GWRDG and would support USGS's recommendation to rehabilitate and expand the hydrologic data collection network and monitoring necessary to ensure sustainable management of NGLA. Expansion/rehabilitation of the NGLA monitoring well network would mitigate significant impacts. The FY 2014 NDAA directed the Secretary of Defense to convene the EAC in part to develop an implementation plan that will address public infrastructure requirements necessary to support the preferred alternative. The implementation plan will detail descriptions of work, costs, and schedules for completion of construction, improvements, and repairs to Guam public infrastructure affected by the realignment, including rehabilitation and expansion of the NGLA monitoring well network. The water and wastewater assessment that DoD prepared to support the Implementation Plan recommended an updated and expanded NGLA monitoring well network. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water and wastewater improvements on Guam. These funds will remain available until expended.**	Potable Water ***SI-M (local) LSI (overall)*** ***NGLA Impact*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Potable Water ***SI-M (local) LSI (overall)*** ***NGLA Impact*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Potable Water ***SI-M (local) LSI (overall)*** ***NGLA Impact*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Potable Water ***SI-M (local) LSI (overall)*** ***NGLA Impact*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Potable Water ***SI*** ***GWA Water System*** Significant indirect impact from increased water demand beyond system capacity. GWA has limited resources to provide water system supply improvements needed to meet indirect demand increases. ***Potential Mitigation Measures*** **Mitigation would be the same as defined in the 2010 ROD.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
LSI Long-term increased demand to DoD and GWA systems. The DoD would have excess capacity until the Marine Corps fully occupies the proposed installation. Long-term operation of approximately 11 new wells would not impact the NGLA overall and localized short term impacts of SI-M are discussed above. Indirect impacts to GWA water system would occur due to the small increase in demand from the proposed action.	***LSI*** Impacts would be similar to Alternative A. The proposed water infrastructure has been designed to meet the needs of the proposed action.	***LSI*** Impacts would be similar to Alternative A. The proposed water infrastructure has been designed to meet the needs of the proposed action.	***LSI*** The current water system for existing facilities would remain in service but be integrated with the proposed expanded water system for operational efficiency. Similar to Alternative A, the proposed water infrastructure has been designed to meet the needs of the proposed action.	***LSI*** Long-term increased demand to DoD and GWA systems. The DoD would have excess capacity until the Marine Corps fully occupies the proposed installation. Long-term operation of approximately 11 new wells would not impact the NGLA overall and localized short term impacts of SI-M are discussed above. Indirect impacts to GWA water system would occur due to the small increase in demand from the proposed action.	***SI-M (local) LSI (overall)*** ***NGLA Impact*** Localized Impacts to NGLA Recent results from the aquifer study indicate that localized increased salinity could result during drought years from this increased extraction rate, which can be limited by shifting water extraction among available wells. For the overall NGLA, total forecast water extraction demands from the NGLA are within estimated sustainable yields with proper aquifer management. The aquifer study would need to be updated for the higher estimated extraction rate under the no action alternative, which could result in a potentially greater impact to the NGLA. ***Potential Mitigation Measures*** **Mitigation would be the same as defined in the 2010 ROD.** ***LSI*** ***DoD Water System (direct impact)*** For DoD water systems, direct impact would be LSI since the DoD water systems would be upgraded to serve the increased needs.
Wastewater ***SI-M*** Operation of the cantonment/family housing facilities under Alternative A would result in significant direct impacts during the period of non-compliance with the 2013 NPDES permit at the Northern District WWTP. However, upgrades to bring the Northern District WWTP into compliance with the permit are expected to be completed early in the operational phase of the proposed action so operation impacts would therefore be significant but mitigable. The existing GWA interceptor sewer system is in a state of deterioration and needs to be refurbished. Increased flow from the proposed action would accelerate this deterioration and could lead to failure of the sewer system. This would represent a significant but mitigable impact. ***Potential Mitigation Measures*** **Improvements and upgrades to the Guam wastewater system would mitigate significant impacts. The FY 2014 NDAA requires the EAC to develop an implementation plan that addresses assistance to public infrastructure requirements necessary to support the preferred alternative. Section 8102 of the FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $106.4 million to the Secretary of Defense, acting through the OEA, for civilian water**	Wastewater ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Wastewater ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Wastewater ***SI-M*** Impacts would be similar to Alternative A. However, impacts would result from permit noncompliance and increased wastewater flows from both Northern District WWTP and Agaña WWTP. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A but would include recommended upgrades of both the Agaña WWTP and Northern District WWTP.**	Wastewater ***SI-M*** Impacts would be similar to Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Wastewater ***SI-M*** For the No-Action Alternative, impacts to wastewater would be similar to those described in the 2010 Final EIS (Volume 6, Chapter 3: Utilities, Section 3.2.4: Wastewater, pages 3-69 to 3-81), with the additional significant but mitigable impact to the collection system from AAFB to the Northern District WWTP. ***Potential Mitigation Measures*** **Mitigation would be the same as described in the 2010 ROD with the addition of refurbishment of the existing collection system from AAFB to the Northern District WWTP.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
and wastewater improvements on Guam. These funds will remain available until expended.					
LSI Agaña WWTP and GWA southern WWTPs would be indirectly impacted by wastewater flows from the induced civilian growth. The minor additional flows from indirect impacts, the long-term, direct impact to each would be less than significant.	***LSI*** Impacts would be similar to Alternative A, there would be less than significant long-term impacts for the collection system and for other wastewater treatment plants and collection systems during operations.	***LSI*** Impacts would be similar to Alternative A, there would be less than significant long-term impacts for the collection system and for other wastewater treatment plants and collection systems during operations.	***LSI*** Impacts would be similar to Alternative A, there would be less than significant long-term impacts for the collection system and for other wastewater treatment plants and collection systems during operations.	***LSI*** Agaña WWTP and GWA southern WWTPs would be indirectly impacted by wastewater flows from the induced civilian growth. The minor additional flows from indirect impacts, the long-term, direct impact to each would be less than significant.	
Solid Waste ***LSI*** The new Layon Landfill has the capacity to accommodate the projected MSW from Alternative A. The long-term increase in solid waste generated by the additional DoD population would be managed by the new transfer station, recycling center, and planned additional solid waste handling trucks/equipment. The proposed action would be consistent with solid waste permit terms and conditions.	Solid Waste ***LSI*** Impacts would be similar to Alternative A, except there would be a small increase in transport of MSW from family housing at South Finegayan to the transfer facility at Finegayan cantonment.	Solid Waste ***LSI*** Impacts would be similar to Alternative A. The existing solid waste resources at AAFB would be able to handle the increased family housing solid waste generation since the number of total housing units is being increased by only approximately 11%. The proposed cantonment at AAFB would have its own new solid waste handling facilities and not impact the existing solid waste facilities at AAFB.	Solid Waste ***LSI*** Impacts would be similar to Alternative A.	Solid Waste ***LSI*** Impacts would be similar to Alternative A. The existing solid waste resources at AAFB would be able to handle the increased family housing solid waste generation since the number of total housing units is being increased by only approximately 11%. The proposed cantonment at Finegayan would have its own solid waste handling facilities and not impact the existing solid waste facilities at AAFB.	Solid Waste ***LSI*** The quantities of solid wastes generated by the No-Action Alternative would be similar to that described in the 2010 Final EIS (Volume 6, Chapter 3) and would be substantially greater than that of the current proposed action. The solid waste disposal capacity on Guam has changed since the 2010 Final EIS due to the opening of the new GovGuam Layon Landfill.
IT/COMM ***LSI*** Long-term, direct impacts to current DoD operations would be less than significant by designing the additional expanded system in an integrated way. Current commercial IT/COMM facilities have adequate capacity within nearby infrastructure.	IT/COMM ***LSI*** Impacts would be similar to Alternative A. IT/COMM infrastructure has been designed to meet project needs.	IT/COMM ***LSI*** Impacts would be similar to Alternative A. There would be minimal potential for short- or long-term adverse environmental consequences to the existing DoD IT/COMM facilities at AAFB. Existing Building 112 at Finegayan has adequate current capacity to handle additional connections for IT/COMM required. The current commercial IT/COMM facilities have adequate capacity within nearby infrastructure. No permanent or long-term environmental consequences to the commercial IT/COMM infrastructure.	IT/COMM ***LSI*** Impacts would be similar to Alternative A. The proposed IT/COMM infrastructure has been developed to meet the requirements for the proposed action. However, for the proposed cantonment/housing area at Barrigada, there is no existing IT/COMM infrastructure so there would be no environmental impacts to users of that resource.	IT/COMM ***LSI*** Long-term, direct impacts to current DoD operations would be less than significant by designing the additional expanded system in an integrated way. Current commercial IT/COMM facilities have adequate capacity within nearby infrastructure for both Finegayan (main cantonment) and AAFB (housing).	IT/COMM ***LSI*** IT/COMM would have slightly more on base routings for the No-Action Alternative due to the increased size of the proposed cantonment/family housing.
SOCIOECONOMICS AND GENERAL SERVICES					
Construction and Operation Impacts	**Construction and Operation Impacts**	**Construction and Operation Impacts**	**Construction and Operation Impacts**	**Construction and Operation Impacts**	**Construction and Operation Impacts**
Population Change ***SI*** The population change associated with the proposed Marine Corps relocation would be considered significant during both the construction and operations phases (given that population change would exceed 2%). Between the years 2021 and 2023 the population with the proposed action is 5.6% higher than it otherwise would have been without the proposed action. At a steady-state the difference would be 4.1%. However, the significant change would not be considered entirely negative. Impacts related to population change would be mixed, with some adverse and some beneficial outcomes, as noted in the following subsections.	Population Change ***SI*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Population Change ***SI*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Population Change ***SI*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Population Change ***SI*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Population Change ***SI*** Population increase during construction would be both beneficial and adverse; population growth fuels economic expansion but sudden population growth would strain government services and the social fabric. ***Potential Mitigation Measures*** **See the 2010 Final EIS, Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Table 2.2-1: Summary of Proposed Mitigation Measures (mitigations specific to Volume 2), Pages 2-25-2-45.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	*Fineqayan/South Fineqayan (Alternative B)*	*Andersen Air Force Base (Alternative C)*	*Barrigada (Alternative D)*	*Fineqayan/Andersen Air Force Base (Alternative E)*	*No-Action Alternative*
Potential Mitigation Measures **No mitigation is proposed as the population increase would not likely result in a sustained increase in demand on Guam's public services and permitting agencies, and the estimated increases in GovGuam tax revenues would likely compensate for any increased demand on public services that would occur.**					
Economic Activity ***LSI*** There would not be a significant impact related to civilian housing demand because there would not be a substantial change to baseline conditions. Effect on rate payers for utilities would be minimal since the estimated increase in power demand could be handled by existing generating capacity. Impacts to tourism would be considered mixed (partially beneficial and partially adverse) and, overall, less than significant. Compared to the overall number of annual visitor arrivals to Guam, the number of construction-related business visitor arrivals would be expected to be small and thus impacts would be considered less than significant. Impacts to Guam's tourism industry from loss of workforce and/or wage increases would be considered less than significant.	Economic Activity ***LSI*** The impacts would be island-wide and would be the same as described under Alternative A.	Economic Activity ***LSI*** The impacts would be island-wide and would be the same as described under Alternative A.	Economic Activity ***LSI*** The impacts would be island-wide and would be the same as described under Alternative A.	Economic Activity ***LSI*** The impacts would be island-wide and would be the same as described under Alternative A.	Economic Activity ***SI*** Substantial stresses related to rapid population influx, potential housing shortage associated with the construction boom. ***Potential Mitigation Measures*** **See the 2010 Final EIS, Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Table 2.2-1: Summary of Proposed Mitigation Measures (mitigations specific to Volume 2), Pages 2-25- 2-45.**
BI Economic impacts would be beneficial, leading to increased employment and standards of living. In 2021, civilian labor force demand with the proposed action would be 11.9% higher than it otherwise would have been, without the project. At 2028, the difference would decline to 2.4% - both representing a beneficial impact. Civilian labor force income would also be higher than it otherwise would have been, during the construction and operations phases. During the operations phase, it is likely that the increase in military personnel would generate more visits from friends and family, as well as more business travel, beneficially impacting the tourism industry. There would be a beneficial impact from increase in civilian labor force income, increase in GIP, and tax revenues during the construction and operations phases.	***BI*** The impacts would be island-wide and would be the same as described under Alternative A.	***BI*** The impacts would be island-wide and would be the same as described under Alternative A	***BI*** The impacts would be island-wide and would be the same as described under Alternative A	***BI*** The impacts would be island-wide and would be the same as described under Alternative A	***BI*** Most long-term economic impacts would be beneficial including growth in employment, income, and gross island product.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Public Services ***SI-M*** During construction, all categories of public services agencies combined would require an estimated 185 additional employees, an increase of 3.6% over baseline staffing levels. This maximum increase in staffing levels would be temporary, lasting from approximately 2021 through 2023. Staffing requirements for many public service agencies would increase by more than 2%, and given existing deficiencies at many agencies, significant impacts were identified. ***Potential Mitigation Measures*** **The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded. Such support may include providing project-related employment and population forecasts, participating in the identification of shortfalls in Guam public services, and assisting in the identification of federal programs and funding sources that may help GovGuam to address shortfalls.** **The DoD would continue to support existing programs that contribute and/or donate excess equipment to local agencies.** ***LSI*** At steady-state (operations phase), GovGuam public services agencies would require an additional 66 staff, an increase of 1.3% over baseline levels, resulting in a less than significant impact.	Public Services ***SI-M*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.** ***LSI*** At steady-state (operations phase), the impacts would be island-wide and would be the same as described under Alternative A.	Public Services ***SI-M*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.** ***LSI*** At steady-state (operations phase), the impacts would be island-wide and would be the same as described under Alternative A.	Public Services ***SI-M*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.** ***LSI*** At steady-state (operations phase), the impacts would be island-wide and would be the same as described under Alternative A.	Public Services ***SI-M*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.** ***LSI*** At steady-state (operations phase), the impacts would be island-wide and would be the same as described under Alternative A.	Public Services ***SI*** Significant adverse impacts to public services during construction and at steady state (operations phase) due to increased requirements for staffing and services. Because of the larger scale of the construction activities and the projected direct, indirect, and induced population growth under the No-Action Alternative, the impacts to public services would be more intensive than any of the alternatives evaluated in this SEIS. ***Potential Mitigation Measures*** **See the 2010 Final EIS, Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Table 2.2-1: Summary of Proposed Mitigation Measures (mitigations specific to Volume 2), Pages 2-25-2-45.**
Sociocultural Issues ***SI-M*** There is a potential for sociocultural impact to occur, but the magnitude of the impacts are difficult to predict and could vary substantially based on policy and program choices yet to be made as how to address them. For these reasons, and for the purposes of this SEIS, impacts to sociocultural issues are conservatively classified as significant but mitigable. ***Potential Mitigation Measures*** **In accordance with the 2011 PA, the DoD will conduct orientation briefs for all incoming DoD personnel, their families, and contractors regarding cultural sensitivity in the area. All DoD personnel and contractors working on Guam will receive annual**	Sociocultural Issues ***SI-M*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Sociocultural Issues ***SI-M*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Sociocultural Issues ***SI-M*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Sociocultural Issues ***SI-M*** The impacts would be island-wide and would be the same as described under Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Sociocultural Issues ***SI*** There would be adverse sociocultural impacts. ***Potential Mitigation Measures*** **See the 2010 Final EIS, Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Table 2.2-1: Summary of Proposed Mitigation Measures (mitigations specific to Volume 2), Pages 2-25-2-45.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	*Fineqayan/South Fineqayan (Alternative B)*	*Andersen Air Force Base (Alternative C)*	*Barrigada (Alternative D)*	*Fineqayan/Andersen Air Force Base (Alternative E)*	*No-Action Alternative*
briefings. The DoD will develop the briefing in consultation with the appropriate SHPO and will provide SHPO with a copy of the final briefing materials. **The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth to address sociocultural issues. See Section 2.9 for further discussion on the CMCC.** **The $12,000,000 appropriated under the FY 2012 Consolidated Appropriations Act (Public Law 112-74) for a Guam Cultural Repository facility remains in place. The appropriation provides funding for a repository for curation of archaeological collections on Guam and to serve as a source of information on Guam history and culture. As directed by the FY 2014 NDAA, the DoD would convene the EAC to consider necessary technical and financial assistance and develop an implementation plan coordinated with EAC federal agencies. This plan must be submitted to the congressional defense committees as part of a reporting requirement that is due no later than the date of issuance of the ROD.**					
HAZARDOUS MATERIALS AND WASTE					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Hazardous Materials Management ***LSI*** Short-term increased hazardous waste generation, storage, handling, and disposal would have short-term direct impacts to human health and the environment. Direct impacts to two existing Installation Restoration Program sites. Indirect, long-term beneficial impact to fuel storage and conveyance infrastructure from being brought into compliance.	Hazardous Materials Management ***LSI*** Impacts would be similar to Alternative A, with the exception that there would be potential direct impacts to one existing Installation Restoration Program site.	Hazardous Materials Management ***LSI*** Impacts would be similar to Alternative A, with the exception that there would be potential direct impacts to six existing Installation Restoration Program sites and one MMRP site.	Hazardous Materials Management ***LSI*** Impacts would be similar to Alternative B.	Hazardous Materials Management ***LSI*** Impacts would be similar to Alternatives A and C.	Hazardous Materials Management ***LSI*** Short-term increased hazardous waste generation, storage, handling, and disposal would have the potential to result in direct impacts to human health and the environment. Although, considered less than significant, the potential direct impacts would be considerably more for the No-Action Alternative when compared to the SEIS alternatives.
Hazardous Waste Management ***LSI*** Short-term increase in generation, transport, storage and handling of hazardous waste. Direct adverse impacts to human health and the environment from short-term increase in hazardous waste. Adherence to applicable BMPs and SOPs would minimize potential direct impact. No long-term direct or in-direct impact on the management of hazardous waste at DoD facilities on Guam.	Hazardous Waste Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Waste Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Waste Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Waste Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Waste Management ***LSI*** Impacts would be similar to Alternative A. Although, considered less than significant, the potential direct impacts would be considerably more for the No-Action Alternative when compared to the SEIS alternatives.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Contaminated Sites ***LSI*** Project design would avoid overlap with contaminated sites. Various BMPs and construction operational protocol would be followed if relocation of construction projects is not possible. Special design techniques and methodology would be required to ensure the long-term structural integrity of proposed construction projects.	Contaminated Sites ***LSI*** Impacts would be similar to Alternative A, except No MMRP sites were identified in the area of South Finegayan proposed for development for family housing under Alternative B.	Contaminated Sites ***LSI*** Impacts would be similar to Alternative A.	Contaminated Sites ***LSI*** Impacts would be similar to Alternative A.	Contaminated Sites ***LSI*** Impacts would be similar to Alternative A.	Contaminated Sites ***LSI*** Impacts would be similar to Alternative A.
Toxic Substances ***LSI*** Demolition of older buildings and/or utilities may result in encountering PCBs, ACM and LBP that were used in the older building materials. Toxic substances would not be utilized for new construction. Because the proposed construction areas are located in a USEPA Radon Zone 1, it is possible that new buildings, facilities, and structures could encounter radon intrusion. To minimize this impact, radon resistant construction techniques and potential mitigation systems would be incorporated into the building/facility designs. In addition, DoD would periodically test facilities constructed in known radon zones to verify that no unacceptable radon gas buildup occurs and install radon mitigation systems as appropriate.	Toxic Substances ***LSI*** Impacts would be similar to Alternative A.	Toxic Substances ***LSI*** Impacts would be similar to Alternative A.	Toxic Substances ***LSI*** Impacts would be similar to Alternative A.	Toxic Substances ***LSI*** Impacts would be similar to Alternative A.	Toxic Substances ***LSI*** Impacts would be similar to Alternative A.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Hazardous Materials Management ***LSI*** Long-term, direct impact from increase in transport/transfer of hazardous materials, primarily from use of POL. Current hazardous materials handling, storage, and disposal capacity is sufficient. BMPs and SOPs would minimize potential direct or indirect impacts. Training use would be in compliance with MCO P5090.2A. Existing hazardous waste accumulation sites would be maintained to support the proposed cantonment/family housing area and a 90-day accumulation area would be provided. In addition, an undetermined number of satellite accumulation sites would be created, as needed, in proximity to hazardous materials use and hazardous waste generation to support cantonment activities.	Hazardous Materials Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Materials Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Materials Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Materials Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Materials Management ***LSI*** Long-term increased hazardous materials storage, handling, and disposal. Increase potential for minor spill, leak, or release direct impacts from long-term increased vehicular traffic.
Hazardous Waste Management ***LSI*** Increase in transport/transfer of hazardous waste on Guam from increased population. New satellite hazardous waste storage areas would be created in proximity to hazardous materials use and hazardous waste generation, and would be managed with applicable regulations.	Hazardous Waste Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Waste Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Waste Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Waste Management ***LSI*** Impacts would be similar to Alternative A.	Hazardous Waste Management ***LSI*** Impacts would be similar to Alternative A. Long-term increased requirement for off-island hazardous waste disposal. Long-term increases to DRMO's hazardous waste storage, handling, and disposal capacity. New hazardous waste accumulation areas established.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Contaminated Sites ***LSI*** Direct or indirect impacts to contaminated sites from operations would be less than significant. Any potentially contaminated sites would be assessed and remediated, as appropriate, for the proposed reuse of the site. Operational activities would not disturb any remediation sites or controls or interfere with monitoring areas.	Contaminated Sites ***LSI*** Impacts would be similar to Alternative A.	Contaminated Sites ***LSI*** Impacts would be similar to Alternative A.	Contaminated Sites ***LSI*** Impacts would be similar to Alternative A.	Contaminated Sites ***LSI*** Impacts would be similar to Alternative A.	Contaminated Sites ***LSI*** Impacts would be similar to Alternative A. Potential impacts to existing IRP/MMRP sites.
Toxic Substances ***LSI*** No significant environmental consequences from ACM, LBP, and PCBs are anticipated. ACM and gases would not be transported or transferred as a result of these activities. Existing BMPs and SOPs would be followed minimizing the potential for releases to the environment. Cantonment operations would have no direct or indirect impact on ACM, LBP, and PCBs. ACM, LBP, and PCBs would not be used in new facilities on Guam. Because the proposed construction areas are located in a USEPA Radon Zone 1, it is possible that new buildings, facilities, and structures could encounter radon intrusion. To minimize this impact, radon resistant construction techniques and mitigation systems would be incorporated into the building/facility designs. In addition, DoD would periodically test facilities constructed in known radon zones to verify that no unacceptable radon gas buildup occurs and install radon mitigation systems as appropriate.	Toxic Substances ***LSI*** Impacts would be similar to Alternative A.	Toxic Substances ***LSI*** Impacts would be similar to Alternative A.	Toxic Substances ***LSI*** Impacts would be similar to Alternative A.	Toxic Substances ***LSI*** Impacts would be similar to Alternative A.	Toxic Substances ***LSI*** Impacts would be similar to Alternative A.
PUBLIC HEALTH AND SAFETY					
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Notifiable Diseases ***LSI*** Potential increase in STDs, notifiable diseases, and mental illness due to increase in population. No adverse impact to health care centers. Implementation of BMPs would reduce potential water-related disease outbreak.	Notifiable Diseases ***LSI*** Impacts would be similar to Alternative A.	Notifiable Diseases ***LSI*** Impacts would be similar to Alternative A.	Notifiable Diseases ***LSI*** Impacts would be similar to Alternative A.	Notifiable Diseases ***LSI*** Impacts would be similar to Alternative A.	Notifiable Diseases ***LSI*** Less than significant impacts to health care services from increases in notifiable diseases and mental illness.
Mental Illness ***LSI*** A potential increase in mental illness occurrences due to the addition of military personnel and dependents, construction workforce, as well as the natural and induced population increase.	Mental Illness ***LSI*** Impacts would be similar to Alternative A.	Mental Illness ***LSI*** Impacts would be similar to Alternative A.	Mental Illness ***LSI*** Impacts would be similar to Alternative A.	Mental Illness ***LSI*** Impacts would be similar to Alternative A.	Mental Illness ***LSI*** Impacts would be similar to Alternative A.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Operational Safety ***NI*** No direct or indirect impacts to public, military personnel, or worker safety are expected from potential construction hazards because a health and safety program would be implemented for construction contractors and the public would be excluded from construction areas.	Operational Safety ***NI*** Impacts would be similar to Alternative A.	Operational Safety ***NI*** Impacts would be similar to Alternative A. The areas proposed for the cantonment and housing at AAFB are situated outside of the APZs.	Operational Safety ***NI*** Impacts would be similar to Alternative A.	Operational Safety ***NI*** Impacts would be similar to Alternatives A and C.	Operational Safety ***NI*** Impacts would be similar to Alternative A.
Environmental Health Effects ***LSI*** Direct and indirect impacts from a short-term increase in construction noise would be less than significant. Wellhead protection zones and construction BMPs would minimize risk of potential groundwater contamination during construction.	Environmental Health Effects ***LSI*** Impacts would be similar to Alternative A. Long-term operational noise from activities occurring within the cantonment and housing areas would be similar to current noise levels.	Environmental Health Effects ***LSI*** Impacts would be similar to Alternative A. Long-term operational noise at AAFB would be similar to current noise levels. The area proposed for the cantonment and housing are within the 60 to 70 dB noise range and are compatible with residential development.	Environmental Health Effects ***LSI*** Impacts would be similar to Alternative A. Long-term operational noise from activities occurring within the cantonment and housing areas would be similar to current noise levels.	Environmental Health Effects ***LSI*** Impacts would be similar to Alternative A and C.	Environmental Health Effects ***LSI*** Less than significant direct impacts due to short-term construction noise.
Hazardous Substances ***NI*** Short and long-term increase in the use, handling, storage, transportation, and disposition of hazardous substances. Existing IRP sites would not affect the proposed development and is not near an off-site population.	Hazardous Substances ***NI*** Impacts would be similar to Alternative A.	Hazardous Substances ***NI*** Impacts would be similar to Alternative A.	Hazardous Substances ***NI*** Impacts would be similar to Alternative A.	Hazardous Substances ***NI*** Impacts would be similar to Alternative A.	Hazardous Substances ***NI*** Impacts would be similar to Alternative A.
Unexploded Ordnance ***LSI*** Because UXO would be identified and removed prior to initiating construction activities and construction personnel would be trained as to the hazards associated with unexploded military munitions, potential direct impacts from encounters with UXO would be minimized and less than significant.	Unexploded Ordnance ***LSI*** Impacts would be similar to Alternative A.	Unexploded Ordnance ***LSI*** Impacts would be similar to Alternative A.	Unexploded Ordnance ***LSI*** Impacts would be similar to Alternative A.	Unexploded Ordnance ***LSI*** Impacts would be similar to Alternative A.	Unexploded Ordnance ***LSI*** Less than significant direct impacts due to potential contact with UXO.
Traffic Incidents ***LSI*** Potential for a small increase in the number of traffic accidents, primarily during operation because of the increase in population, but potentially also during construction activities.	Traffic Incidents ***LSI*** Impacts would be similar to Alternative A.	Traffic Incidents ***LSI*** Impacts would be similar to Alternative A.	Traffic Incidents ***LSI*** Impacts would be similar to Alternative A.	Traffic Incidents ***LSI*** Impacts would be similar to Alternative A.	Traffic Incidents ***LSI*** Less than significant impacts due to potential increase in traffic incidents.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Notifiable Diseases ***LSI*** Similar to the construction impacts, operations would result in less than significant impacts to health care services from increases in illnesses related to notifiable diseases and mental illness.	Notifiable Diseases ***LSI*** Impacts would be similar to Alternative A.	Notifiable Diseases ***LSI*** Impacts would be similar to Alternative A.	Notifiable Diseases ***LSI*** Impacts would be similar to Alternative A.	Notifiable Diseases ***LSI*** Impacts would be similar to Alternative A.	Notifiable Diseases ***LSI*** Less than significant impacts to health care services from increases in notifiable diseases.
Mental Illness ***LSI*** Similar to the construction impacts, operations would result in increase in mental illness occurrences due to the addition of military personnel and dependents, construction workforce, as well as the natural and induced population increase.	Mental Illness ***LSI*** Impacts would be similar to Alternative A.	Mental Illness ***LSI*** Impacts would be similar to Alternative A.	Mental Illness ***LSI*** Impacts would be similar to Alternative A.	Mental Illness ***LSI*** Impacts would be similar to Alternative A.	Mental Illness ***LSI*** Impacts would be similar to Alternative A.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
Operational Safety ***NI*** Similar to construction impacts, operations would result in no impacts to operational safety.	Operational Safety ***NI*** Impacts would be similar to Alternative A.	Operational Safety ***SI*** In the event of a munitions transport incident or explosives incident at the North Gate, a significant direct impact related to explosive safety could occur. ***Potential Mitigation*** **No Mitigation. Siting the proposed cantonment/family housing in another location would be required to eliminate the potential need for evacuations in the event of a munitions transportation mishap.**	Operational Safety ***NI*** Impacts would be similar to Alternative A.	Operational Safety ***NI*** Impacts would be similar to Alternative A.	Operational Safety ***NI*** Similar to construction impacts, operations would result in no impacts to operational safety.
Environmental Health Effects ***LSI*** Similar to the construction impacts, operations would result in less than significant direct impacts due to long-term operations noise. Operations would result in less than significant direct impacts to water quality as a result of increased long-term demand and potential water related illness.	Environmental Health Effects ***LSI*** Impacts would be similar to Alternative A.	Environmental Health Effects ***LSI*** Impacts would be similar to Alternative A.	Environmental Health Effects ***LSI*** Impacts would be similar to Alternative A.	Environmental Health Effects ***LSI*** Impacts would be similar to Alternative A.	Environmental Health Effects ***LSI*** Impacts would be similar to Alternative A, there would be less than significant long-term direct impacts to water quality and noise.
Hazardous Substances ***NI*** Similar to construction impacts, operations would result in no impacts to hazardous substances use.	Hazardous Substances ***NI*** Impacts would be similar to Alternative A.	Hazardous Substances ***NI*** Impacts would be similar to Alternative A.	Hazardous Substances ***NI*** Impacts would be similar to Alternative A.	Hazardous Substances ***NI*** Impacts would be similar to Alternative A.	Hazardous Substances ***NI*** Similar to construction impacts, operations would result in no impacts to hazardous substances use.
Unexploded Ordnance ***LSI*** Similar to the construction impacts, operations would result in less than significant direct impacts relative to potential contact with UXO.	Unexploded Ordnance ***LSI*** Impacts would be similar to Alternative A.	Unexploded Ordnance ***LSI*** Impacts would be similar to Alternative A.	Unexploded Ordnance ***LSI*** Impacts would be similar to Alternative A.	Unexploded Ordnance ***LSI*** Impacts would be similar to Alternative A.	Unexploded Ordnance ***LSI*** Less than significant direct impacts due to potential contact with UXO.
Traffic Incidents ***LSI*** Similar to the construction impacts, operations would result in less than significant long-term impacts due to potential increase in traffic incidents.	Traffic Incidents ***LSI*** Impacts would be similar to Alternative A.	Traffic Incidents ***LSI*** Impacts would be similar to Alternative A.	Traffic Incidents ***LSI*** Impacts would be similar to Alternative A.	Traffic Incidents ***LSI*** Impacts would be similar to Alternative A.	Traffic Incidents ***LSI*** Less than significant long-term impacts due to potential increase in traffic incidents.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	***Fineqayan/South Fineqayan (Alternative B)***	***Andersen Air Force Base (Alternative C)***	***Barrigada (Alternative D)***	***Fineqayan/Andersen Air Force Base (Alternative E)***	***No-Action Alternative***
ENVIRONMENTAL JUSTICE AND THE PROTECTION OF CHILDREN					
Construction and Operation Impacts	**Construction and Operation Impacts**	**Construction and Operation Impacts**	**Construction and Operation Impacts**	**Construction and Operation Impacts**	**Construction and Operation Impacts**
Noise ***LSI*** Construction activities would result in short-term, direct noise impacts to surrounding communities, but minority, low-income, or children populations would not be disproportionately affected. Operational noise would not be significant and would not disproportionately affect minority, low-income, or children populations.	Noise ***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	Noise ***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	Noise ***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	Noise ***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	Noise ***LSI*** Environmental justice impacts from noise impacts would be less than significant.
Recreation ***LSI*** Increased construction traffic would decrease access to recreational sites, but minority, low-income, or children populations would not be disproportionately affected. Operationally, all people of Guam would be affected by impacts to recreational resources, so there would not be a disproportionate effect on minority, low-income, or children populations.	Recreation ***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	Recreation ***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	Recreation ***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	Recreation ***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	Recreation ***LSI*** Environmental justice impacts from impacts to recreational resources would be less than significant.
Socioeconomics and General Services ***SI-M*** Temporary population growth may stress some sectors of the Guam economy (e.g., housing, costs of goods and services). In the short-term (during construction), direct and indirect impacts to health services would be significant; during the steady-state period (operational phase), impacts to public health and human service agencies would be less than significant. This would be felt more severely by low-income people, who often do not have resources to buffer hard economic times. However, there would also be some economic benefits due to increased employment opportunities. There would be adverse and disproportionate socioeconomic impacts in terms of environmental justice on low-income populations; however, some of the socioeconomic impacts would be beneficial (e.g., economic impacts). ***Potential Mitigation Measures*** **The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded. Such support would include providing**	Socioeconomics and General Services ***SI-M*** Impacts are generally island-wide and would be the same as described for Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Socioeconomics and General Services ***SI-M*** Impacts are generally island-wide and would be the same as described for Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Socioeconomics and General Services ***SI-M*** Impacts are generally island-wide and would be the same as described for Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Socioeconomics and General Services ***SI-M*** Impacts are generally island-wide and would be the same as described for Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Socioeconomics and General Services ***SI*** The "boom and then bust" cycle of population growth and decline may stress the Guam economy and public services. This would be felt more severely by low-income people, who often do not have resources to buffer hard economic times. ***Potential Mitigation Measures*** **See the 2010 Final EIS, Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Table 2.2-1: Summary of Proposed Mitigation Measures (mitigations specific to Volume 2), Pages 2-25-2-45.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

Fineqayan (Alternative A)	*Fineqayan/South Fineqayan (Alternative B)*	*Andersen Air Force Base (Alternative C)*	*Barrigada (Alternative D)*	*Fineqayan/Andersen Air Force Base (Alternative E)*	*No-Action Alternative*
project-related employment and population forecasts, participating in the identification of shortfalls in Guam public services, and assisting in the identification of federal programs and funding sources that would help GovGuam to address shortfalls. **As directed by the FY 2014 NDAA, the DoD would convene the EAC to consider necessary technical and financial assistance and develop an implementation plan coordinated with EAC federal agencies. This plan must be submitted to the congressional defense committees as part of a reporting requirement that is due no later than the date of issuance of the ROD.**					
Public Health and Safety ***SI-M*** Since the number of public health and safety professionals required to maintain current levels of service at public health and safety agencies would increase by more than 2%, and due to existing deficiencies in facilities and equipment at these agencies, there would be short-term, direct and indirect significant impacts to public health agencies and significant direct and indirect impacts on public safety agencies, both short-term (during construction) and during the steady-state period (during operation). Given that public health agencies that serve low-income and uninsured populations already have insufficient staffing levels, population increase would further strain these resources, causing a significant environmental justice impact. ***Potential Mitigation Measures*** **The DoD would continue to support the efforts of the CMCC to develop recommendations, as appropriate, regarding adjustment of construction tempo and sequencing to directly influence workforce population levels and indirectly influence induced population growth before infrastructure capabilities are exceeded. Such support may include providing project-related employment and population forecasts, participating in the identification of shortfalls in Guam public services, and assisting in the identification of federal programs and funding sources that may help GovGuam to address shortfalls.** **The FY 2014 Consolidated Appropriations Act (Public Law No. 113-76) appropriated $13,000,000 for the construction of a regional public health laboratory on Guam;**	Public Health and Safety ***SI-M*** Impacts are generally island-wide and would be the same as described for Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Public Health and Safety ***SI-M*** Impacts are generally island-wide and would be the same as described for Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Public Health and Safety ***SI-M*** Impacts are generally island-wide and would be the same as described for Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Public Health and Safety ***SI-M*** Impacts are generally island-wide and would be the same as described for Alternative A. ***Potential Mitigation Measures*** **Mitigation would be the same as under Alternative A.**	Public Health and Safety ***SI*** Guam's public health care services would not be able to handle potential increases in illnesses of the medically underserved and low income populations. In addition access to public health and social services would be strained by an increase in uninsured and underinsured workers coming to Guam. Construction-related impacts are considered short-term but significant and would have a corresponding significant impact on low-income people. ***Potential Mitigation Measures*** **See the 2010 Final EIS, Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Table 2.2-1: Summary of Proposed Mitigation Measures (mitigations specific to Volume 2), Pages 2-25-2-45.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 4.7-1. Summary of Impacts and Potential Mitigation Measures for the Cantonment/Family Housing Alternatives

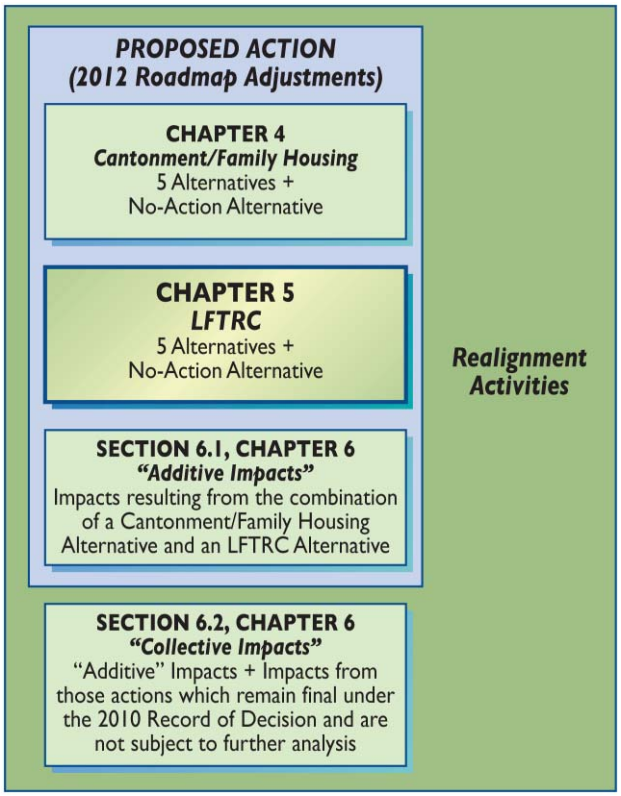
Fineqayan (Alternative A)	*Fineqayan/South Fineqayan (Alternative B)*	*Andersen Air Force Base (Alternative C)*	*Barrigada (Alternative D)*	*Fineqayan/Andersen Air Force Base (Alternative E)*	*No-Action Alternative*
these funds remain in place. The public health laboratory would alleviate some existing deficiencies in Guam's public health infrastructure, and bolster Guam's capability to meet public health demands brought about by project-related population, by providing a facility that would help identify, treat, and control diseases of public health concern. As directed by the FY 2014 NDAA, the DoD would convene the EAC to consider necessary technical and financial assistance and develop an implementation plan coordinated with EAC federal agencies. This plan must be submitted to the congressional defense committees as part of a reporting requirement that is due no later than the date of issuance of the ROD.					
LSI There would be less than significant impacts to health care services. Less than significant impacts are anticipated from noise, water quality, UXO, and traffic incidents due to the increase in military personnel and natural population increase. There would be a less than significant environmental justice impacts from impacts to these resources.	***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	***LSI*** Impacts are generally island-wide and would be the same as described for Alternative A.	

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

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CHAPTER 5
AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES AT LIVE-FIRE-TRAINING RANGE COMPLEX SITE ALTERNATIVES

This chapter describes the affected environment and potential environmental consequences associated with the LFTRC component of this SEIS proposed action. As shown in the box at right, this is the second of three major sections of this SEIS that analyze the direct and indirect impacts of the 2012 Roadmap Adjustments. The impacts associated with the cantonment alternatives are addressed in Chapter 4 and the impacts that are unique to specific combinations of a cantonment/family housing alternative and an LFTRC alternative are addressed in Chapter 6.1. When considered in conjunction with the related Marine Corps actions that remain final under the 2010 ROD, as is done in Chapter 6.2, the resulting "collective" impacts represent the total impacts related to the proposed Marine Corps relocation to Guam.



Chapter 5 is structured around each of the five action alternatives for the LFTRC plus the No-Action Alternative, with associated subsections to address the 18 environmental resource areas that were evaluated for each alternative. The *Affected Environment* subsection for each resource area describes the baseline environmental conditions in the proposed project areas. These baseline conditions provide a comparative framework for evaluating the impacts to each resource, which are presented in the *Environmental Consequences* subsections. In compliance with CEQ regulations implementing NEPA, the environmental consequences discussion includes both direct and indirect impacts. The impact analyses also take into account the implementation of the BMPs included in the proposed action as described in Chapter 2 of this SEIS. At the end of Chapter 5, following the impact analysis for each LFTRC is a table that summarizes the impacts and potential mitigation by alternative for each resource subsection (Table 5.7-1).

The box at right summarizes the elements of the proposed action for the LFTRC that are analyzed in this chapter. These include the construction and operation of the LFTRC at one of the five alternative sites, associated utility infrastructure both on- and off-site, and the construction and operation of the HG Range at Andersen South.

Chapter 5: Live-Fire Training Range Complex

Proposed Action Includes:

- ✓ Choice of 5 action alternatives or No-Action:
  1. Route 15
  2. NAVMAG East/West
  3. NAVMAG North/South
  4. NAVMAG L-Shaped
  5. Northwest Field
- ✓ Onsite and offsite utilities unique to each LFTRC Alternative (electric power, limited water and wastewater requirements)
- ✓ Hand Grenade Range at Andersen South (common to all LFTRC Alternatives)

As appropriate to each alternative and each resource area, applicable information from the 2010 Final EIS that remains relevant in the context of this SEIS is incorporated by reference and briefly summarized. Each subsection then places particular emphasis on updating any key resource information that changed since the 2010 Final EIS, and on presenting any new information regarding baseline conditions or environmental consequences that was not included in the 2010 Final EIS.

5.1 ROUTE 15 LIVE-FIRE TRAINING RANGE COMPLEX - ALTERNATIVE 1

Under Alternative 1, the proposed development of a live-fire training range complex would occur on land crossed by Route 15 adjacent to Andersen South. Details about this alternative are provided in Section 2.5.4.1 and the proposed site is illustrated in Figure 2.5-2.

5.1.1 Geological and Soil Resources

5.1.1.1 Affected Environment

The affected environment for geological and soil resources associated with Route 15 LFTRC Alternative 1 is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.1.3.3: Non-DoD Land which is summarized below for reference. The affected environment for geological and soil resources associated with the stand-alone HG Range at Andersen South is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.1.3.1: Andersen South). The proposed reduction in the number of relocating Marines and dependents under the proposed action does not alter the description of the affected environment for geological and soil resources, but it would reduce some potential impacts to geological and soil resources that were determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, as described in the analysis of environmental consequences for Alternative 1 below.

Route 15 LFTRC Alternative 1 would be located in a topographically hilly area on the eastern side of Guam's northern limestone structural province. Within the proposed project footprint, the ground surface slopes downward from northeast to southwest. Elevations range from approximately 300 feet (91 m) above MSL on the slope between Pågat Plateau and Sasayan Valley east of Route 15 to approximately 560 feet (171 m) MSL on a ridge approaching Lujuna Peak north of Pågat Plateau. East of Pågat Plateau is a steep cliffline that drops down to the Sasayan Valley below and then to the Pacific Ocean. All construction for Route 15 LFTRC Alternative 1 would take place on the limestone plateau. The only Alternative 1-related improvements below the plateau would consist of a line of warning signs posted on the range boundaries and along the shoreline.

The HG Range site at Andersen South is located about 0.6 mile (0.9 km) to the west of Alternative 1. The proposed site of the HG Range stands at an elevation of approximately 374 feet (114 m) MSL, at the crest of a gentle ridge.

Bedrock underlying the Route 15 LFTRC Alternative 1 footprint and the HG Range site is young (Mariana) limestone, the geologic setting for sinkhole formation (see Section 3.1.1.1). One major and one minor bedrock fault cross the length of the Alternative 1 footprint, trending from northeast to southwest roughly parallel with Route 15 (Figure 5.1.1-1). No bedrock faults are mapped in the HG Range footprint. Other major and minor bedrock faults are mapped to the northeast of the proposed Alternative 1 footprint. Based on available topographic and field data, three features have been preliminarily identified as sinkholes/depressions that may contain sinkholes within, or on the perimeter of, the proposed Route 15 LFTRC Alternative 1 footprint.

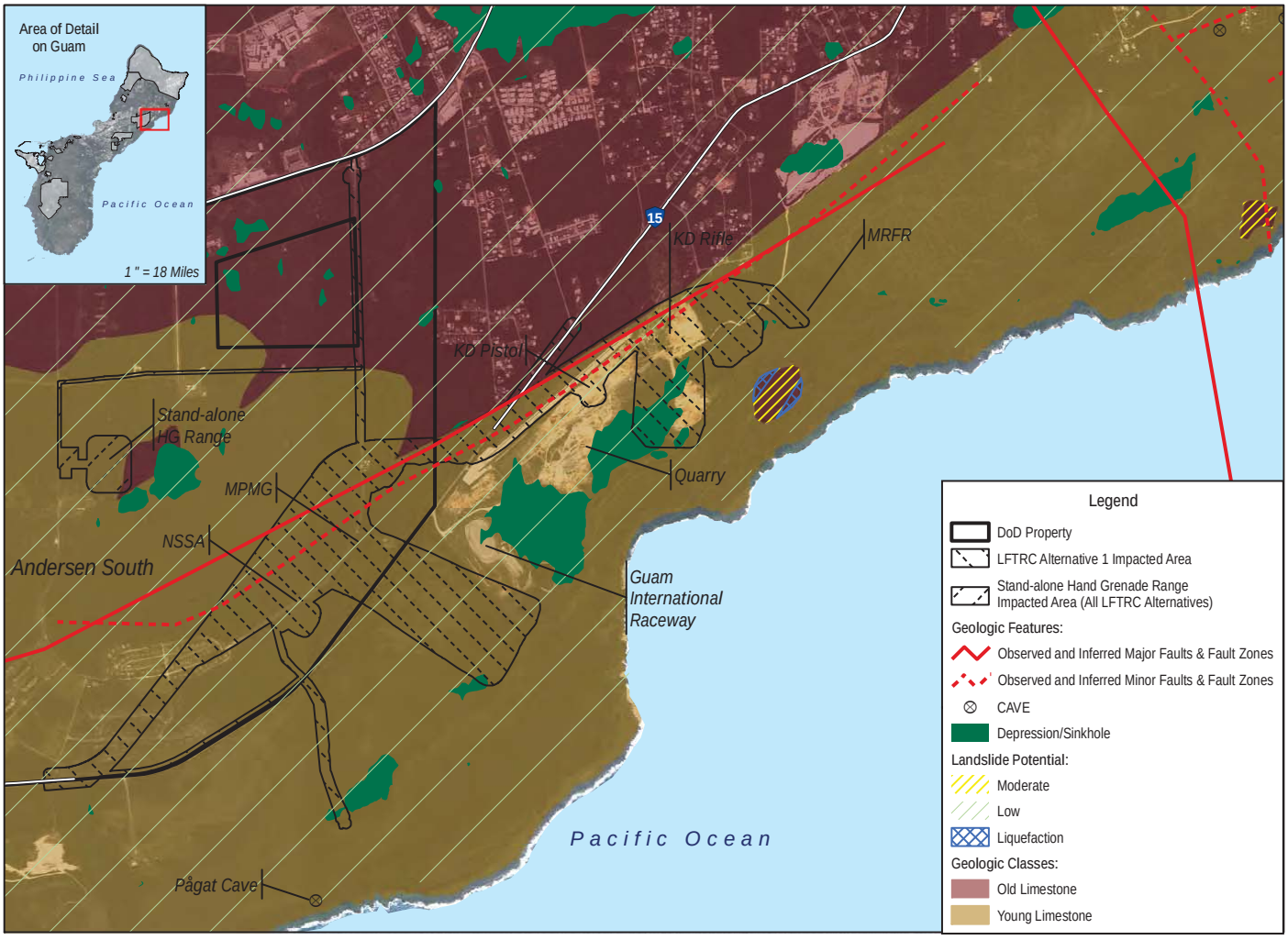


Figure 5.1.1-1
Geologic Features in the Vicinity of Route 15 LFTRC Alternative 1

Sources: COMNAV Marianas 2008; GovGuam 2008; NAVFAC Pacific 2013; Taborosi 2004; WERI 2001

Guam Urban Land Complex, Guam Cobbly Clay Loam, and Ritidian-Rock Outcrop Complex comprise the soils of Route 15 LFTRC Alternative 1. The HG Range site soil consists of Guam Cobbly Clay Loam (Figure 5.1.1-2). Guam Cobbly Clay loam is shallow well-drained soil, runoff is slow, and the water erosion hazard is slight (Young 1988). For the Ritidian-Rock Outcrop Complex soil, runoff is very slow and the water erosion hazard is slight (Young 1988). Urban Land comprises land covered by roads, buildings, parking lots and other impervious surfaces (Young 1988).

Subsistence farming currently takes place on less than 1% of the undeveloped land in the proposed acquisition area for Alternative 1 (see Section 5.1.6 of this SEIS). The land where the HG Range would be constructed is located inside Andersen South and used for military purposes. Prime farmland soils, as defined by the USDA, are soils best suited to producing food, seed, forage, fiber and oilseed crops, favorable for economic production and sustained high yield, with minimal inputs of energy and resulting in least damage to the environment (Young 1988). None of the soils in the Alternative 1 and HG Range footprints are identified by USDA as prime farmland (Young 1988).

5.1.1.2 Environmental Consequences

Potential geology and soil impacts addressed in this section are limited to elements of the proposed action that could affect onshore landforms or that could be affected by geologic hazards. Potential soil contamination issues are addressed in Section 5.1.16.2 of this SEIS (Hazardous Materials and Waste).

Construction

Construction of the Route 15 realignment would be similar to the description in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.2.2.2: Non-DoD Land), which is summarized below for reference. Route 15 would be moved into Andersen South about 0.3 mile (0.5 km) north of its current alignment (Figure 2.5-2 in Section 2.5.4.1 of this SEIS). The new Route 15 would be constructed below grade for 1.2 miles (1.9 km) of its 1.7-mile (2.8 km) length. Its average distance (depth) below grade would be 15 feet (5 m). Construction of the Route 15 realignment would involve clearing, grubbing, soil moving and mass grading for proper highway grade. Earthwork for construction of the Route 15 realignment would include 323,509 yd^3 (247,340 m^3) of excavation (cut) and 34,837 yd^3 (26,635 m^3) of fill, resulting in a net 288,672 yd^3 (220,705 m^3) of cut.

Construction of the new ranges, range support building, roads, bridges, and related infrastructure associated with Alternative 1 would include clearing, grubbing and grading, and excavation (cut) and filling. Earthwork for Alternative 1 range construction would include 2,488,676 yd^3 (1,902,730 m^3) of cut and 2,451,937 yd^3 (1,874,640 m^3) of fill, resulting in a net of 36,740 yd^3 (28,090 m^3) of cut. Alternative 1 would involve a smaller excavation volume than Alternatives 3 and 4, and a larger volume than Alternatives 2 and 5 (Alternative 3 would involve the greatest; Alternative 2 would require the least).

Within the Alternative 1 footprint, there are major differences in elevation in the areas planned for construction of the MPMG Range, MRF Range and KD Rifle Range. There would be substantial changes to surface elevation for construction of the MPMG Range, MRF Range and KD Rifle Range. Because of the major elevation changes, the substantial alteration of the surrounding landscape, and the amount of excavation, filling and contouring that would occur; construction of the Alternative 1 is expected to have a significant direct, long-term impact on topography.

Construction of the HG Range at Andersen South would involve 8,894 yd^3 (6,800 m^3) of cut and 12,641 yd^3 (9,665 m^3) of fill, for a net of 3,747 yd^3 (2,865 m^3) of fill. The 36,740 yd^3 (28,090 m^3) of cut generated by construction of the other Alternative 1 ranges would provide sufficient additional fill to supply the need at the HG Range.

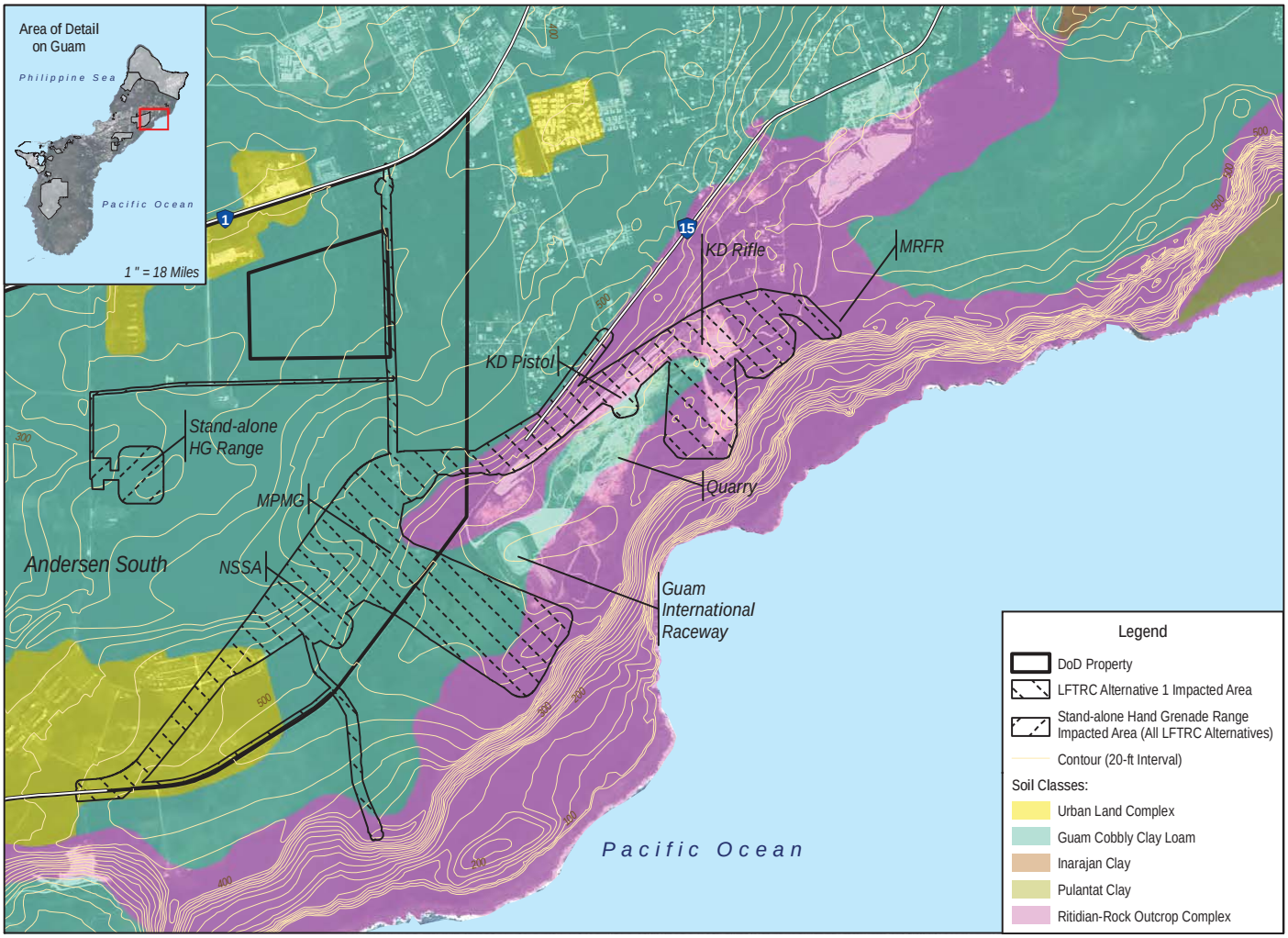


Figure 5.1.1-2
Soils in the Vicinity of Route 15 LFTRC Alternative 1

Potential mitigation is not considered feasible for this impact because smaller cut/fill volumes would not provide the necessary level surfaces for the referenced ranges and roadway. This significant impact to topography would occur with implementation of any LFTRC Alternative except Alternative 2, which would involve the least amount of cut and fill (i.e., the impact would be similar for all alternatives except Alternative 2).

Construction of the HG Range without Alternative 1 would include the same activities as described for LFTRC Alternative 1, but would involve much smaller amounts of cut (8,890 yd^3 [6,600 m^3]) and fill (12,641 yd^3 [9,645 m^3], with a net 3,747 yd^3 [2,865] m^3) of fill. Grading, contouring, and changes to elevation would not be substantial, so direct, long-term impacts to topography from construction of the HG Range alone would be less than significant.

There is a potential for increased erosion, compaction, and soil loss from physical disturbance caused by construction activity and changes to existing topography. However, project design and construction for realignment of Route 15, Alternative 1 ranges and the HG Range would incorporate engineering controls as BMPs to minimize erosion within the project construction footprint, as required by Title 22 of GAR, Chapter 10 Guam Soil Erosion and Sediment Control Regulations. Examples of such engineering controls include:

- Use of drainage diversion and control to temporarily direct runoff from adjacent undisturbed areas away from construction sites.
- Use of benches or terraces and drainage control on cut or fill slopes higher than 15 feet (5 m) to minimize erosion on slope faces.
- Compliance with the DoD Program-level SWPPP for construction, in addition to individual project SWPPPs during construction to reduce the potential for erosion, runoff, sedimentation, and stormwater pollutant loading.
- For each project, limit the size of the unstabilized disturbed areas to less than 20 acres (8 ha) during construction.
- Planning earth-moving operations for periods of low rainfall to minimize exposure of disturbed soil to potential runoff.
- Re-vegetating and permanently stabilizing disturbed areas as soon as possible.
- Engineering project slopes in consideration of soil and geological conditions to avoid and minimize erosion.

In addition, construction activities associated with Alternative 1 and the HG Range would comply with the Construction General Permit. Potential construction-specific stormwater BMPs would be implemented in compliance with the Construction General Permit as listed in Table 4.1.2-2. Construction-specific stormwater BMPs would provide erosion and sediment control during the construction period, generally by employing on-site measures that reduce the flow of stormwater and minimize the transport of soils and sediment off-site. Fill material would be generated on-site, whenever possible. In addition, roadway-specific BMPs, as identified in the most recent *CNMI and Guam Stormwater Management Manual*, would be included in the planning, design, and construction of all roadways and facilities. There would be no stream re-routing involved with construction of Alternative 1. Through compliance with 22 GAR Chapter 10 § 10106F and the Construction General Permit and implementation of roadway stormwater BMPs, and because the rate of erosion and soil loss would not be substantially increased, direct, short-term impacts to soils from erosion during construction of Alternative 1 and the HG Range would be less than significant. In addition, no indirect, short-term impacts associated with soil erosion are expected.

The soil that would be disturbed in construction of the Route 15 realignment, Alternative 1 ranges, and the HG Range is not identified as prime farmland and is used minimally for farming (Young 1988). Therefore, disturbance of soil during construction of the Route 15 realignment, Alternative 1 ranges, and the HG Range would have a less than significant direct, long-term impact to agricultural soils.

There are three topographic features that may contain sinkholes within, or on the perimeter of, the Alternative 1 footprint. No such features are identified for the HG Range footprint. However, the HG Range is underlain by limestone bedrock (see Figure 5.1.1.1). For any sinkholes discovered before or during construction, implementation of BMPs would include compliance with 22 GAR Chapter 10 § 10106F. In order to ensure compliance with 22 GAR Chapter 10 § 10106F, BMPs would be modified or an environmental and hydrogeologic assessment must be performed to ensure adverse effects will not result, including but not limited to the displacement of groundwater, interference with well production, significant changes to groundwater recharge, flooding, or the threat or introduction of any pollutant to groundwater. After a preferred alternative is selected and the ROD is signed for the proposed project, final design work would begin for the preferred alternative site. A geotechnical study, including subsurface borings, would be conducted to determine whether the depressions on the site contain sinkholes, and whether there are additional sinkholes not evident from the surface. Hydrogeological studies would be conducted to confirm groundwater flow at the site as well. The geotechnical and hydrogeological studies would be coordinated with the GEPA to design and implement an appropriate analysis. These studies would be part of the final design process and would take place before any construction begins. With implementation of these BMPs, and because no sinkholes would be filled that would adversely affect site drainage, no adverse impacts to sinkholes would occur. Therefore, construction of Alternative 1 and the HG Range would have less than significant direct, short-term impacts to sinkholes.

Hazards associated with earthquakes, fault rupture and slope instability would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 (USACE 2013). The realigned Route 15, Alternative 1 ranges and the HG Range would be located higher than the elevation prone to tsunamis, and so would not be susceptible to inundation. The consolidated limestone bedrock underlying the Route 15 LFTRC Alternative 1 and the proposed HG Range footprints is not subject to liquefaction. There would not be a change to soil and/or bedrock conditions that would increase vulnerability to a geologic hazard. As stated in the previous paragraph, 22 GAR Chapter 10 § 10106F requires that for sinkholes within the project development footprint that would be modified or used, an environmental and hydrogeologic assessment must be performed to ensure adverse effects will not result. Compliance with these regulations would minimize potential geologic hazards associated with sinkholes. Therefore, construction of Route 15 LFTRC Alternative 1 and the HG Range would result in less than significant direct and indirect short-term impacts with respect to geologic hazards.

Operation

Operation of the proposed Route 15 realignment, Alternative 1 ranges and the HG Range would not alter topography post construction, so no direct or indirect impacts to topography would occur.

Operational activities and conditions that may directly cause or increase naturally occurring soil erosion at a firing range would include ongoing soil disturbances resulting from vehicular and pedestrian traffic and inadequate maintenance of vegetated areas. The changes to topography caused by construction of the MPMG Range, MRF Range and KD Rifle Range and the realignment of Route 15 raise the risk of erosion during the operational phase, because graded features (cut and fill slopes) and altered surface flow patterns can potentially create conditions that may promote additional soil erosion.

The area of impervious surfaces that would be constructed for the ranges and associated infrastructure (range buildings, roads, and parking areas) would comprise approximately 30.8 acres (12.5 ha) total (see Appendix F) including about 29.9 acres (12.1 ha) for Alternative 1 and about 0.9 acre (0.4 ha) for the HG Range. There would be a minor increase in runoff from the new impervious surfaces as compared with existing conditions. Stormwater infrastructure improvements included as part of the proposed action would incorporate LID measures and BMPs as described in Section 5.1.2.2 of this SEIS to minimize soil erosion from increased runoff. Where possible, stormwater flow paths would continue to mimic pre-development flows through area topography. Stormwater BMPs that would be implemented to minimize and control runoff as described in Section 5.2.2.2 would also minimize soil erosion. Implementation of roadway-specific BMPs in the planning, design, and construction of the Route 15 realignment would minimize the potential for soil erosion associated with increased impervious surfaces and changes to elevation resulting from the realignment.

The range complex and the HG Range would be managed in accordance with current Marine Corps range management policies and procedures, which are designed to ensure the safe, efficient, effective, and environmentally sustainable use of the range area. A thorough explanation of Marine Corps range management is detailed in the 2010 Final EIS (Volume 2, Chapter 2: Description of Proposed Action and Alternatives, Section 2.3.1.4: Firing General Military Skills, pages 2-55 to 2-59). Marine Corps range management policies and procedures include procedures for removing expended rounds from live-fire ranges with impact berms, managing stormwater, controlling erosion, maintaining vegetation on berms and drainage ways and turf on the range, and restricting vehicular activities to designated/previously identified areas. Range roads would be maintained to minimize erosion.

Because the NGLA is used as a source for drinking water, prior to the construction of the ranges, both a site inspection and a site assessment, as well as actual munitions loading data, would be provided to the Marine Corps' Range Environmental Vulnerability Assessment (REVA) and Operational Range Clearance (ORC) programs. These programs would use the site specific data to determine the appropriate frequency of monitoring and range clearance.

Under the REVA Program, site specific data would be used to evaluate the potential for MCs to reach potential receptors. This would allow the REVA program to determine whether follow-on actions would be required (e.g., sampling, additional studies) and the frequency of any further evaluations. The REVA assessment would use conservative assumptions and available site specific information to determine if modeling can be performed for lead components. Monitoring of the ranges for MCs migrating off-range would be based on the outcome of the REVA assessment. REVA assessments would begin in the first year of operation and would then be conducted at a minimum every 5 years.

The ORC program would not only consider the site-specific and REVA data but also safety and sustainability considerations in its assessment to determine the required frequency of range clearance.

Munitions constituents associated with small arms ammunition commonly used at operational ranges include lead, antimony, copper, and zinc. Lead is the primary munitions constituent indicator for small arms ranges because lead is the most prevalent (by weight) constituent associated with small arms ammunition. No specific quantitative conclusions can be made regarding the fate and transport of lead, because lead is geochemically specific regarding its mobility in the environment. Site-specific conditions are required (i.e., geochemical properties) in order to quantitatively assess lead migration. Site-specific geochemical properties are only identified via sampling and cannot be observed physically. Without site-specific physical and chemical characterization, lead cannot effectively be modeled using fate and transport modeling. The scientific community has established that metallic lead (such as recently fired,

un-weathered bullets and shot) generally has low chemical reactivity and low solubility in water and is relatively inactive in the environment under most ambient or everyday conditions. However, a portion of lead deposited on a range may become environmentally active if the right combination of conditions exists.

As indicated in the above paragraphs, a site inspection and site assessment will be completed at the range and the site-specific information provided to the REVA Manager. The REVA manager will utilize this site-specific information in their assessments of the range, which begin the first year of range operation. Assessing small arms ranges first involves defining and documenting its physical and environmental conditions, as well as how the range is utilized and maintained. The assessment process involves a review of possible factors that can influence the potential for lead to migrate off range including range use and management (source), surface water, groundwater and soil conditions, pathways and receptors (including but not limited to people, sensitive and endangered species). Upon review, if factors or a combination of factors are found to exist that would indicate possible lead migration, REVA program managers consider sampling appropriate media, identifying and implementing BMPs adjustments, or taking other steps as required.

Quarterly inspections of the range BMPs will also be performed. Inspections will lead to identifying if BMPs are still in place or if maintenance is required. Any deficiencies that cannot be immediately addressed will be reported to the Public Works Department for corrective action. Additionally, the REVA program will also evaluate BMP effectiveness and recommend adjustments as needed.

The DON will investigate additional technologies that could assist with range design and minimizing potential impacts (specific technologies or brands were not mentioned to ensure the full range of BMPs are considered). Prior to the construction of the range, the DON will perform a site survey/inspection to inform range design activities, to include evaluating the optimal site grading and any necessary soil amendments to minimize range constituent migration. Appropriate BMPs will be evaluated and incorporated into the design and construction of the range to minimize the off-site migration of stormwater runoff and reduce the infiltration of MCs (e.g. vegetation buffers, pH adjustment of soil and water quality/quantity BMPs). Designs will subsequently be coordinated and approved through Head, Range Design and Safety, Commanding General Marine Corps Combat Development Command.

There would be minor ground disturbance associated with utility maintenance. Construction stormwater BMPs would be implemented during maintenance activities to minimize and control runoff on-site and minimize potential effects of erosion.

Agriculturally-productive soils would be disturbed. Existing agricultural use of soils in the disturbed area is minimal, and the disturbed soils would not be in areas identified as prime farmland. Therefore, disturbance of these soils during the Alternative 1 and HG Range operational phase would be an adverse, but less than significant direct, long-term impact.

A potential indirect impact of firing range operations includes the possibility of live ammunition causing wildland fires. As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's *Wildland Fire Management Plan* (USFS 2008). It would include protocols for monitoring fire conditions and adjusting training as needed. Units undergoing training at the ranges would be briefed by range control on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). With these measures, potential wildfires caused by the live ammunition would be unlikely. Effects to soils from erosion associated with wildfires associated with operation of Alternative 1 and the HG Range would be minimal and direct and indirect impacts would be less than significant.

With implementation of Marine Corps range management policies and procedures, fire suppression and potential mitigation measures, and stormwater BMPs (for ranges and utility maintenance), and because the rate of erosion and soil loss would not be substantially increased, less than significant direct and indirect long-term impacts to soils from erosion would occur due to Alternative 1 and HG Range operations.

The BMPs for sinkholes would be implemented in the event that maintenance activities should involve sinkholes or their immediate perimeter, so no adverse impacts to sinkholes would occur. Therefore, Alternative 1 and HG Range operations would have less than significant direct, long-term impacts to sinkholes.

Hazards associated with earthquakes, fault rupture and slope instability would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 (USACE 2013) during project design and construction, so direct and indirect long-term impacts with respect to seismic hazards would be less than significant. The consolidated limestone bedrock underlying Alternative 1 and the HG Range site is not vulnerable to liquefaction. The Route 15 realignment, Alternative 1 and the HG Range would be sited higher than the elevation prone to tsunamis, so they would not be susceptible to inundation. In addition, there would not be a change to soil and/or bedrock conditions that would increase vulnerability to a geologic hazard. Implementation of sinkhole BMPs would minimize potential geologic hazards associated with sinkholes. Therefore, operation of realigned Route 15, Alternative 1 and the HG Range would have less than significant direct and indirect long-term impacts associated with geologic hazards.

5.1.2 Water Resources

5.1.2.1 Affected Environment

The affected environment for water resources in the Alternative 1 project area is described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.1.3.1: Andersen South and Section 4.1.3.2: Non-federal land, pages 4-34 and 4-35). A summary of site conditions for Alternative 1 is provided in Appendix F.

Surface Water

As indicated in the 2010 Final EIS, there are no surface water resources in the Route 15 project area or the project area for the HG Range on Andersen South (Figure 5.1.2-1). Impervious areas on the Route 15 parcel amount to 71 acres (28.7 ha), or 3.5% of the total Route 15 parcel area of 2,031 acres (822 ha). Impervious areas on Andersen South amount to 132 acres (53 ha), or 6.4% of the total Andersen South area of 2,061 acres (834 ha). There are no 100-year flood zones identified within the proposed construction area. The 500-year flood zones identified within the proposed construction area are shown in Figure 5.1.2-1.

Groundwater

As indicated in the 2010 Final EIS, Route 15 land primarily overlies the Mangilao Basin and a small portion of the Yigo Basin, both of which are part of the NGLA. As also described in that document, the project area for the HG Range overlies the very permeable limestone in the Yigo Basin within the larger NGLA. The groundwater model being developed by the USGS (USGS 2013) includes the Mangilao and Yigo basins and the current well production is the same as described under Alternative A in Section 4.1.2.1 of this SEIS.

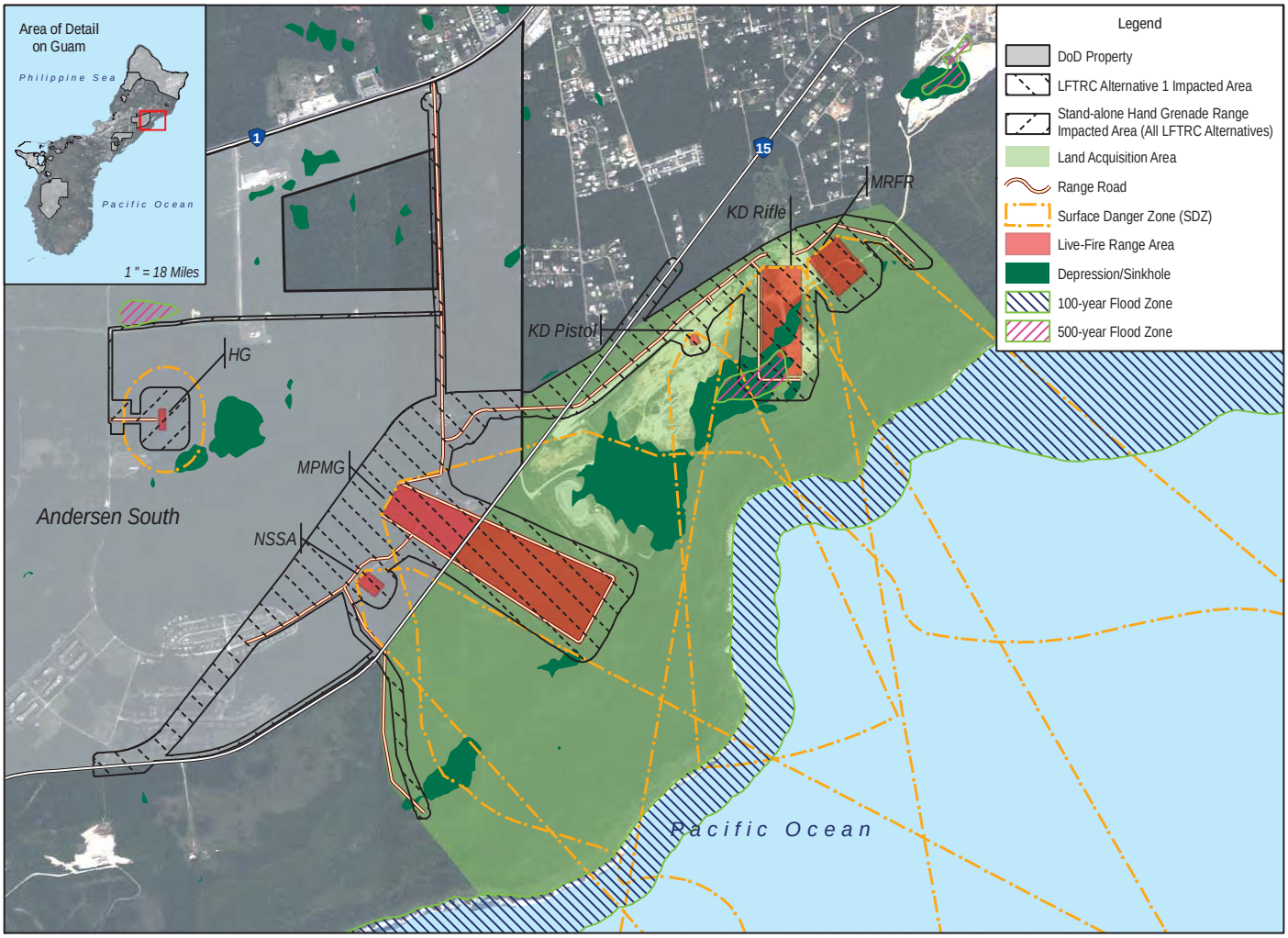


Figure 5.1.2-1
Water Resources in the Vicinity of Route 15 LFTRC Alternative 1

Nearshore Waters

As described in the 2010 Final EIS, the Route 15 project area is located along the eastern coast of Guam along Pågat Point, and has no public beaches. Nearshore waters are mostly inaccessible to the public because there are no roads, few trails, steep terrain, and a lack of safe boat landing areas due to rough sea conditions for much of the year (Figure 5.1.2-1). The project area for the HG Range is adjacent to and inland from the Route 15 project area.

Wetlands

As indicated in the 2010 Final EIS, no wetlands were identified in the Route 15 and HG Range project areas (Figure 5.1.2-1).

5.1.2.2 Environmental Consequences

Construction

General construction impacts to water resources under Alternative 1 would be similar to those described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-84 to 4-88) and under Alternative A in Section 4.1.2.2 of this SEIS. Under Alternative 1, there would be construction activities associated with the proposed LFTRC ranges in the Route 15 and HG Range project areas. Similar to Alternative A, Alternative 1 would occur in an area that does not contain any waters of the U.S. but would comply with the Construction General Permit as described under Alternative A.

Construction under Alternative 1 would result in the potential for short-term increases in stormwater runoff and erosion. However, through compliance with the Construction General Permit and Program SWPPP and implementation of a site-specific SWPPP and associated erosion control, runoff reduction, and sediment removal BMPs (see Table 4.1.2-2), these effects would be minimized and off-site transport of stormwater runoff would be unlikely unless during extreme weather events (i.e., typhoons). Specifically, the site-specific SWPPP would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flow rate of runoff and thereby minimize transport of suspended sediment through settling and promote infiltration of runoff.

Surface Water

No buildings/structures would be constructed in the 100-year flood zone and the proposed KD Rifle Range located in the 500-year flood zone (see Figure 5.1.2-1) would be in compliance with EO 11988 as the construction would not be categorized as a "critical action." No surface waters are located within or near the proposed construction areas under Alternative 1. Given compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely. Therefore, construction activities associated with Alternative 1 would result in no direct or indirect short-term impacts to surface water.

Groundwater

Construction activities under Alternative 1 would include stormwater runoff protection measures that would also serve to protect groundwater quality. By adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific water resource protection requirements, there would be a reduction in stormwater pollutant loading potential and thus a reduction in pollution loading potential to the underlying groundwater basins of the NGLA. As described under Alternative A, an environmental and hydrogeologic assessment for the selected alternative would be performed for sinkholes within the project development footprint to ensure adverse

effects to groundwater resources would not occur. Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs) and the environmental and hydrogeologic assessment for sinkhole protection (if encroachment is unavoidable), construction activities associated with Alternative 1 would result in less than significant direct or indirect short-term impacts to groundwater.

Nearshore Waters

The Route 15 and HG Range project areas would be located approximately 0.2 mile (0.3 km) and 1.3 miles (2.1 km), respectively, from nearshore waters (see Figure 5.1.2-1). Given compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely (see discussion of BMPs under *Construction*). In addition, vegetative cover between the construction area and the edge of the steep cliffline and the shoreline would provide an additional buffer and protection from stormwater runoff or sediment reaching nearshore waters. Given adherence to the provisions of the Construction General Permit and implementation of BMPs, it is expected that stormwater runoff, sediment, or other pollutants would not discharge to nearshore waters. Therefore, construction activities associated with Alternative 1 would result in no direct or indirect impacts to nearshore waters.

Wetlands

No wetlands are located in or near the construction areas associated with Alternative 1. Therefore, construction activities associated with Alternative 1 would result in no impacts to wetlands.

Operation

Alternative 1 would incorporate the concept of LID in the final planning, design, and construction of the stormwater management system as described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-85 to 4-87) and under Alternative A in Section 4.1.2.2 of this SEIS. Stormwater runoff associated with the operational phase of Alternative 1 would be similar as described under the Route 15 option in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.2: Central, page 4-97). Minimal increases in stormwater runoff from increased impervious area would be accommodated through the implementation of LID measures and BMPs. Alternative 1 would potentially increase the amount of POLs, hazardous waste, herbicides, pesticides, and fertilizers being stored, transported, and utilized on the proposed facilities. However, impacts from these contaminants would be minimized with the implementation of a SWPPP, SWMP, and SPCC plan.

Alternative 1 would include implementation of the REVA program and range management preventative measures (i.e., vegetation, pH adjustment, LID). The REVA program utilizes available site-specific data and actual munitions loading data to determine further assessments regarding the potential for an identified receptor to be impacted by potential munition constituent migration through an identified pathway (see Section 5.5.1.2, Operation). As listed in Section 2.8 of this SEIS, the BMPs would reduce the potential for contaminants to migrate off-site. In addition, DoD would investigate additional technologies that could assist with range design and management to minimize potential impacts. Baseline data on water quality and range site conditions would be collected prior to range construction and quarterly monitoring would occur during operations to verify the effectiveness of BMPs. For each range, water quality treatment strategies would be selected to achieve reductions of non-point source pollutants to meet the same water quality requirements as identified under Alternative A in Section 4.1.2.2 of this SEIS.

Surface Water

No surface waters are located within the Alternative 1 project area and the implementation of an appropriate and comprehensive stormwater management plan utilizing a LID approach and range management BMPs would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event. Therefore, implementation of Alternative 1 would result in no impacts to surface water.

Groundwater

Potential impacts to groundwater associated with the operational phase of Alternative 1 would be similar to those described under the Route 15 option in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.2: Central, pages 4-97 to 4-98) and summarized in Chapter 2 of this SEIS. Range operations under Alternative 1 have the potential to leach MCs to the groundwater. However, range management BMPs would be implemented, as listed in Section 2.8 of this SEIS. As indicated in the 2010 Final EIS, the Route 15 project area overlies the Mangilao Basin and a small portion of the Yigo Basin of the NGLA.

Because the NGLA is used as a source for drinking water, prior to the construction of the ranges, both a site inspection and a site assessment, as well as actual munitions loading data, would be provided to the Marine Corps' REVA and ORC programs. These programs would use the site specific data to determine the appropriate frequency of monitoring and range clearance.

Under the REVA Program, site specific data would be used to evaluate the potential for MCs to reach potential receptors. This would allow the REVA program to determine whether follow-on actions would be required (e.g., sampling, additional studies) and the frequency of any further evaluations. The REVA assessment would use conservative assumptions and available site specific information to determine if modeling can be performed for lead components. Monitoring of the ranges for MCs migrating off-range would be based on the outcome of the REVA assessment. REVA assessments would begin in the first year of operation and would then be conducted at a minimum every 5 years.

The ORC program would not only consider the site-specific and REVA data but also safety and sustainability considerations in its assessment to determine the required frequency of range clearance.

Munitions constituents associated with small arms ammunition commonly used at operational ranges include lead, antimony, copper, and zinc. Lead is the primary munitions constituent indicator for small arms ranges because lead is the most prevalent (by weight) constituent associated with small arms ammunition. No specific quantitative conclusions can be made regarding the fate and transport of lead, because lead is geochemically specific regarding its mobility in the environment. Site-specific conditions are required (i.e., geochemical properties) in order to quantitatively assess lead migration. Site-specific geochemical properties are only identified via sampling and cannot be observed physically. Without site-specific physical and chemical characterization, lead cannot effectively be modeled using fate and transport modeling. The scientific community has established that metallic lead (such as recently fired, un-weathered bullets and shot) generally has low chemical reactivity and low solubility in water and is relatively inactive in the environment under most ambient or everyday conditions. However, a portion of lead deposited on a range may become environmentally active if the right combination of conditions exists.

As indicated in the above paragraphs, a site inspection and site assessment will be completed at the range and the site-specific information provided to the REVA Manager. The REVA manager will utilize this site-specific information in their assessments of the range, which begin the first year of range operation. Assessing small arms ranges first involves defining and documenting its physical and environmental conditions, as well as how the range is utilized and maintained. The assessment process involves a review of possible factors that can influence the potential for lead to migrate off range including range use and management (source), surface water, groundwater and soil conditions, pathways and receptors (including but not limited to people, sensitive and endangered species). Upon review, if factors or a combination of factors are found to exist that would indicate possible lead migration, REVA program managers consider sampling appropriate media, identifying and implementing BMPs adjustments or taking other steps as required.

Quarterly inspections of the range BMPs will also be performed. Inspections will lead to identifying if BMPs are still in place or if maintenance is required. Any deficiencies that cannot be immediately addressed will be reported to the Public Works Department for corrective action. Additionally, the REVA program will also evaluate BMP effectiveness and recommend adjustments as needed.

The DON will investigate additional technologies that could assist with range design and minimizing potential impacts (specific technologies or brands were not mentioned to ensure the full range of BMPs are considered). Prior to the construction of the range, the DON will perform a site survey/inspection to inform range design activities, to include evaluating the optimal site grading and any necessary soil amendments to minimize range constituent migration. Appropriate BMPs will be evaluated and incorporated into the design and construction of the range to minimize the off-site migration of stormwater runoff and reduce the infiltration of MCs (e.g. vegetation buffers, pH adjustment of soil and water quality/quantity BMPs). Designs will subsequently be coordinated and approved through Head, Range Design and Safety, Commanding General Marine Corps Combat Development Command.

All proposed ranges under Alternative 1, except for the HG Range at Andersen South and the MPMG Range, would be entirely located to the southwest of the groundwater divide, which places a low permeability barrier (i.e., volcanic basement rock) between the ranges and the Marbo production wells (Figure 5.1.2-2). A portion of the MPMG Range would be located to the west of the groundwater divide and could potentially leach contaminants to the Marbo production wells (Figure 5.1.2-2). However, the potential for contaminants would be primarily at the eastern end of the MPMG Range where the berm area would be located, and therefore isolated from the Marbo production wells by the low permeability barrier. HQMC commissioned a study on the effects of pumping and drought on the NGLA (USGS Scientific Investigations Report 2013-5216: *The Effects of Withdrawals and Drought on Groundwater Availability in the Northern Guam Lens Aquifer, Guam*). Information from this report will be used to adjust pumping rates in order to avoid increased salinization and reversal of groundwater flow patterns.

Impacts associated with the ranges would be minimized through implementation of the REVA program and range management preventative measures (i.e., vegetation, pH adjustment, LID) listed in Section 2.8 of this SEIS. The HG Range at Andersen South would be located near the Marbo #8 and Marbo #9 wells (Figure 5.1.2-2). However, the HG Range has been sited outside of the 1,000-foot (300-m) wellhead protection zone in accordance with GEPA regulations, and potential impacts to groundwater from contaminants would be minimized through implementation of BMPs listed in Section 2.8 of this SEIS.

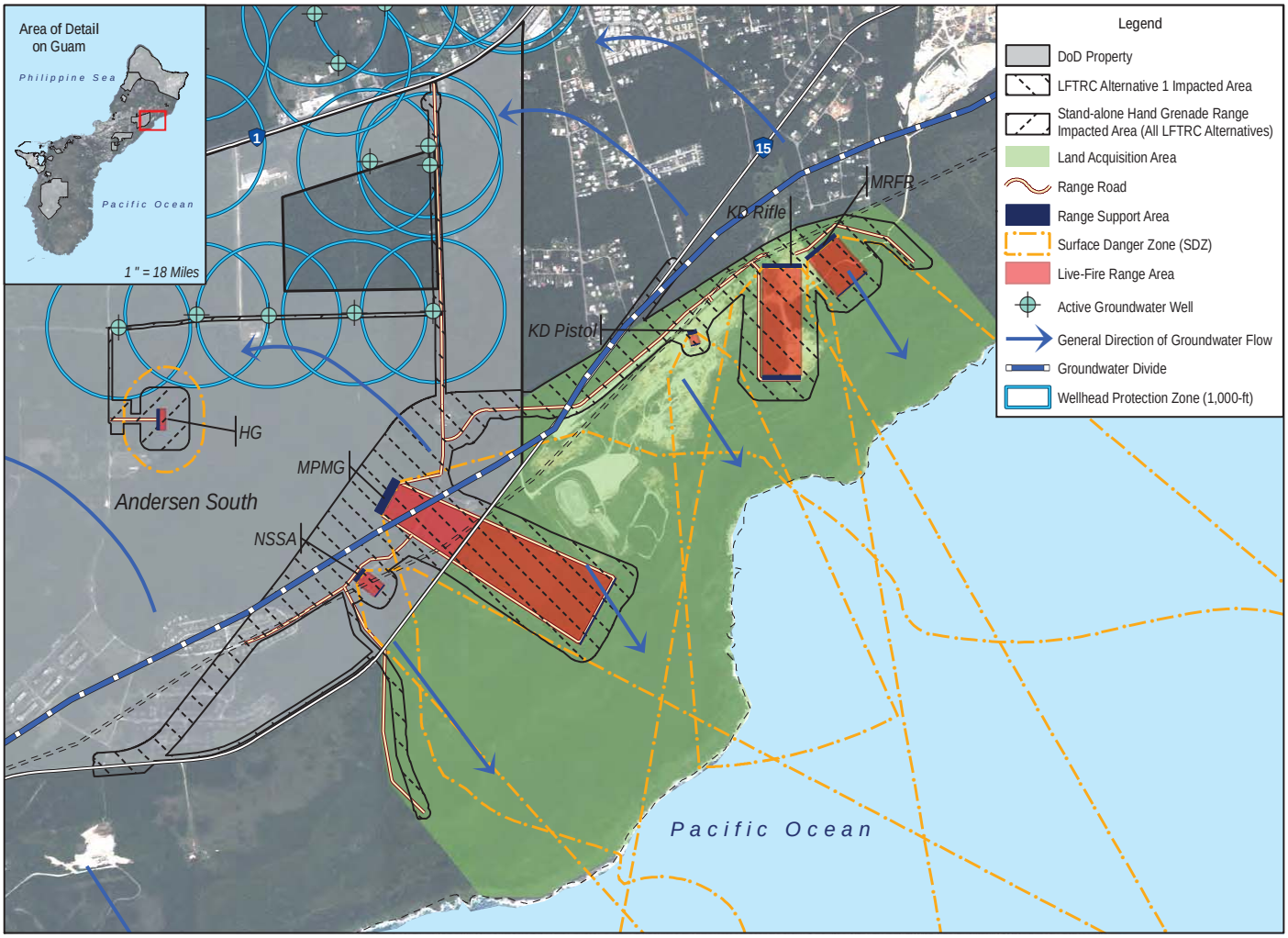


Figure 5.1.2-2
Groundwater Wells in the Vicinity of Route 15 LFTRC Alternative 1

Given the aforementioned BMPs, including the REVA program, and the location of range activities in relation to active and proposed wells, operations associated with Alternative 1 would result in less than significant long-term, direct or indirect impacts to groundwater.

Nearshore Waters

Under Alternative 1, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would ensure that there would be no increase in off-site transport of stormwater runoff, sediment, or other pollutants to nearshore waters for up to the 25-year design storm event. In addition, vegetative cover between the project area and the edge of the steep cliffline and the shoreline would provide an additional buffer and protection from stormwater runoff or sediment reaching nearshore waters. Therefore, there would be no impacts to nearshore waters from stormwater runoff associated with increased impervious areas and training activities under Alternative 1.

The SDZ associated with the Alternative 1 LFTRC range would overlap nearshore waters by approximately 2,805 acres (1,135 ha) (see Figure 5.1.2-1). There would be a very small chance that an expended projectile would fall outside of the range footprint, within the SDZ. There would be an even smaller chance for an expended projectile to fall within the nearshore water portion of the SDZ. Due to the small number of potential projectiles that could fall into the nearshore SDZ and the relatively small size of the projectiles, potential impacts to nearshore water quality from these projectiles would be negligible under Alternative 1.

Wetlands

No wetlands are located within or near the proposed operational areas under Alternative 1. Therefore, operations associated with Alternative 1 would result in no impacts to wetlands.

5.1.3 Air Quality

5.1.3.1 Affected Environment

Ambient air quality conditions along Route 15 where LFTRC Alternative 1 would be developed are affected primarily by mobile source emissions along Route 15 and aircraft operations at AAFB. The closest main stationary combustion source, Marbo Power Station, is owned by the GPA and located approximately 2 miles (3.2 km) due west of the proposed LFTRC, and would also affect air quality conditions in the neighborhood around the proposed site. Table 5.1.3-1 shows the permitted emissions from Marbo Power Station. Sensitive populations near the site are relatively small in size, and are scattered along those major routes, such as Route 15.

Table 5.1.3-1. GPA Marbo Power Station—Existing Permitted Emissions

Station Name	***Permitted Annual Emissions (tpy)***				
	SO_2	***CO***	***PM_{10}***	***NO_x***	***VOC***
Marbo	86.6	31.4	9.4	58.0	14.4

Legend: SO_2 = Sulfur Dioxide; CO = Carbon Monoxide; PM_{10} = Particulate Matter (<10 microns); NO_x= Nitrogen Oxides; VOC = Volatile Organic Compounds; tpy = tons per year.
Source: USEPA 2009.

5.1.3.2 Environmental Consequences

Construction

Annual Emissions

Direct emissions of criteria pollutants and CO_2 from operations of on-site equipment and construction vehicles were estimated based on the acreage of disturbed earth and the number and type of facilities to be constructed within the 2-year duration of the overall construction period. The direct emissions are summarized in Table 5.1.3-2 and are predicted to be well below the significance criterion of 250 tpy. This comparison evaluation is further elaborated in Chapter 6, by combining both cantonment/family housing and Alternative 1 elements in terms of annual emissions with comparison of the 250 tpy threshold. A similar GHG emissions comparison is also included in Chapter 6.

Table 5.1.3-2. Live-Fire Training Range Complex Annual Construction Emissions (2015-2022)

	Construction	***Pollutant (tpy)***						
	Year (Percent Activity)	***SO_2***	***CO***	***PM_{10}***	***$PM_{2.5}$***	***NO_x***	***VOC***	***CO_2***
Alternatives 1 - 5	2017	0.1	3.4	0.4	0.3	5.2	0.7	705.3
	2018	0.1	3.4	0.4	0.3	5.2	0.7	705.3

Legend: SO_2 = Sulfur Dioxide; CO = Carbon Monoxide; PM_{10} = Particulate Matter (<10 microns); $PM_{2.5}$= Particulate Matter (<2.5 microns); NO_x= Nitrogen Oxides; VOC= Volatile Organic Compounds; CO_2= Carbon Dioxide; tpy = tons per year.

On-Site Equipment and Vehicle PM Hot-Spot Analysis

Under Alternative 1, the annual on-site PM emission levels predicted and summarized in Table 5.1.3-2 are much less than under Alternative A (see Table 4.1.3-2 in Chapter 4 of this SEIS; i.e., 0.4 tpy as compared to 2.8 tpy for PM_{10} under Alternative A) for which a hot-spot impact modeling was conducted. Therefore, the on-site hot-spot PM impacts from equipment and vehicle operations around construction sites are anticipated to be much less than those under Alternative A, as shown in Table 4.1.3-3 in Chapter 4 of this SEIS.

Off-Site On-Road Vehicle Hot-Spot Analysis for PM

As described in Section 4.1.3, under the worst-case alternative; the future worst-case construction year annual average daily traffic of the roadways within the study area are well below the USEPA defined screening threshold of 125,000 annual average daily traffic and 8% diesel truck traffic, which equates to 10,000 trucks. A further hot-spot dispersion modeling analysis using AERMOD or CAL3QHCR is not warranted, and there would be no PM hot-spot concerns along the affected roadway network. Because the diesel truck component under Alternative 1 would be less than the worst-case alternative (Alternative A), there would no PM hot-spot concerns.

Off-Site On-Road Vehicle Hot-Spot Analysis for CO and MSATs

The construction associated with on-road truck activities under Alternative 1 would occur along the same truck routes available for all alternatives. The detailed hot-spot impact analysis was conducted for the worst-case condition under the Alternative A, as discussed in Sections 3.3.3 and 4.1.3, and the analysis concludes that the direct, short-term impacts under Alternative A would be less than significant. Because the truck activities associated with Alternative 1 would be much less than those under Alternative A, the off-site, on-road vehicle hot-spot impacts are anticipated to be much less than those under Alternative A, as shown in Tables 4.1.3-4 for CO, 4.1.3-5, 4.1.3-6 for carcinogenic MSATs, and 4.1.3-7 for non-carcinogenic MSATs.

Operation

The hot-spot impact analyses of on-road vehicle CO, PM, and MSATs emissions during operational years were conducted for both the preferred and worst-case alternatives (i.e., Alternative A and Alternative D), as discussed in Sections 4.1.3 and 4.4.3, and show less than significant long-term impacts. Because the on-road traffic with potential to be generated under Alternative 1 would be substantially less than either Alternative A or Alternative D, the anticipated on-road hot-spot impacts during operational years would be much less than those under Alternative A or Alternative D; resulting in less than significant direct, long-term hot-spot air quality impacts.

Based on these findings, Alternative 1 would result in less than significant short- and long-term direct or indirect air quality impacts during both construction and operational phases.

5.1.4 Noise

5.1.4.1 Affected Environment

As stated in the 2010 Final EIS (Volume 2, Chapter 6: Noise, Section 6.1.3: Central, pages 6-13 and 6-17), basic non-live fire ground maneuver training in the Alternative 1 area occurs on Andersen South. These activities include routine training exercises, camp/tent setup, survival skills, land navigation, day/night tactical maneuvers and patrols, blank munitions and pyrotechnics firing, treatment and evaluation of casualties, fire safety, weapons security training, perimeter defense/security, and field equipment training. Vacant single-family housing and vacant dormitories are used for military operations on urban terrain training and small-unit tactics in support of vehicle and foot-based maneuver training. Noise-generating activities associated with this training include vehicle use, use of breacher charges and pyrotechnics, and small arms firing. Although residential land use occurs along the Andersen South boundary, there are no noise issues as these operations are conducted at interior locations of the installation, away from the Alternative D site boundary.

Noise levels from aircraft operations at AAFB near the Route 15 lands currently range below 65 dB and a finger of the 60 dB contour extends just to the north of the Guam International Raceway as shown on Figure 4.1.4-1.

In addition, on the Route 15 lands, noise is generated from activities at Guam International Raceway, which is Guam‘s only automobile raceway. The 250-acre (101-ha) parcel includes a 14 mile (23 km) dirt track, a 0.5 mile (0.8 km) asphalt NASCAR type track, a 1 mile (1.6 km) long off-road course, and a paved 2.25 mile (3.6 km) Formula Three track. Racing events at Guam International Raceway generate noise from racing vehicles and crowd activity.

People living in areas adjacent to the Route 15 lands experience exposure to elevated noise due to the limited military training on Andersen South and Guam International Raceway events. While these noise levels have not been quantified, they are intermittent and return to ambient noise levels upon completion of the noise events. During inactive times at Andersen South and the Raceway, ambient noise levels equate to approximately 50-60 dB (USEPA 1978).

5.1.4.2 Environmental Consequences

Construction

Noise generated during LFTRC construction with the potential to affect sensitive receptors would be due to grading and construction activities at the firing lines and at the range operations facilities located closest to the nearest receptors. Grader and scraper noise would be approximately 67 dB at the nearest

receptor. Construction would be short-term and noise would not exceed construction noise level standards and guidelines. Direct, short-term noise impacts are considered less than significant.

Operation

The main source of noise associated with Alternative D would be small arms training at the proposed range complex. Small arms to be fired at these ranges would include the 9 mm pistol, the .45 caliber pistol, the 5.56 mm rifle, the 7.62 mm machine gun, and the .50 caliber machine gun. Because it is an inert training round, the 40 mm MK 19 TP that would be authorized for use at the machine gun multipurpose range was also assessed as small arms munitions. Under this alternative, existing noise generated by Guam International Raceway activities would no longer occur as the facility would no longer operate in this area.

The estimated average annual number of rounds for each type of live-fire training event for both Marine Corps and Joint Use operations is provided in Chapter 2, Table 2.2-4 of this SEIS. Marine Corps daytime usage would total approximately 4,275,000 rounds and night usage would be approximately 1,063,000 rounds. Night firing training requirements need to be met during hours of darkness, dusk until dawn, and this timeframe differs from "acoustic" night (10 p.m. to 7 a.m.). Of the 1,063,000 rounds expected to be fired during darkness, only 326,000 rounds or 7% of the total number of rounds would occur during "acoustic" night and no training is planned to occur between the hours of 10:00 p.m. and 6:00 a.m.

There are two major noise sources generated from small arms munitions firing. The first is the muzzle blast from the firing of a bullet. The second is the noise from the bow shock wave (also known as ballistic wave) generated by the supersonic bullet. The bow shock wave propagates out from the path of the bullet. The bullet from an M16 has an exit velocity of approximately 3,100 feet (945 m) per second, but decelerates quickly.

Firing noise from single shots merged in bursts, machine gun burst, and concurrent firing of multiple weapons, as would occur at the proposed ranges, would result in short periods of intense firing noise followed by longer periods of silence. There is increased annoyance associated with this noise exposure pattern. Under these conditions, the number of shots becomes more important than the dB level of the typical (average) shot because of the combined effect of greater noise levels of multiple noise events occurring over a short period.

The results of the Alternative 1 noise modeling (Army 2013) are shown in Figure 5.1.4-1. Under this alternative, the Zone 2 noise contours cover approximately 130 onshore acres (53 ha) beyond the boundaries of Route 15 lands and Zone 3 affects about 3 acres (1 ha). Offshore, Zone 2 would cover approximately 577 acres (233 ha) but no Zone 3 contours extend offshore. The estimated population affected by Zone 2 would be 88 people, and no persons would be affected in Zone 3. Table 5.1.4-1 lists the Noise Zones and the associated acreage affected within each zone. Noise generated by Joint Service users at the LFTRC would fall within the contours shown because the noise contours were calculated as an average busy day and the use by other services would be more infrequent and less intense than Marine Corps usage.

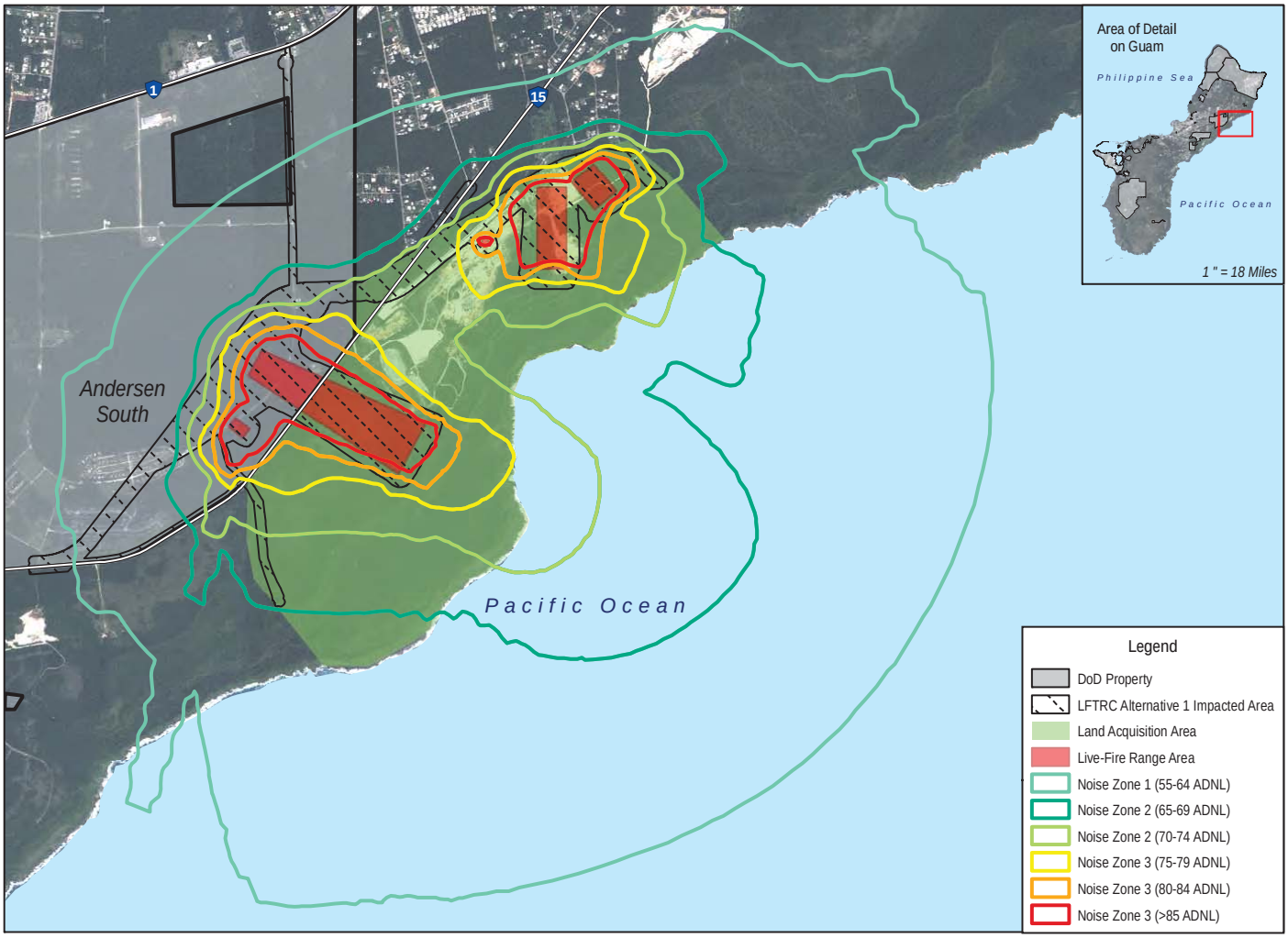


Figure 5.1.4-1
Small Arms ADNL Noise Zones for Route 15 LFTRC Alternative 1

Table 5.1.4-1. Noise Exposure within Noise Zones under LFTRC Alternative 1

Noise Zone (dB ADNL)[1]	*Acreage (ha)*			*Estimated Population*	
	On-base	*Off-base*			
		Onshore	*Offshore*	*Houses*	*People*[2]
Noise Zone 2					
65 - 69	254 (103)	98 (40)	482 (195)	18	72
70 - 74	349 (141)	32 (13)	95 (38)	4	16
Total Zone 2	**603 (244)**	**130 (53)**	**577 (233)**	**22**	**88**
Noise Zone 3					
75 - 79	183 (74)	3 (1)	0	0	0
80 - 84	98 (40)	0	0	0	0
85+	179 (72)	0	0	0	0
Total Zone 3	**460 (186)**	**3 (1)**	**0**	**0**	**0**
Total	**1,063 (430)**	**133 (54)**	**577 (233)**	**22**	**88**

Notes: [1] Zone 1 is not listed because all land uses are compatible within Zone 1.
[2] Based upon four persons per household in Yigo (GBSP 2010).
Source: Army 2013; NAVFAC Pacific 2013.

In addition to the LFTRC, a HG Range would be located in the central part of Andersen South. This range would be common to all proposed LFTRC alternatives. The proposed HG Range would include an approximately 0.9 acre (0.4 ha) area that would be developed as a training facility for the M67 fragmentation hand grenade. It would consist of a demonstration area with bleachers, an open practice throwing field with various targets and throwing positions located outside the hazard zone, and a parking area. A 1.0 acre (0.4 ha) training area would be developed adjacent to the range (additional details pertaining to the proposed HG Range are provided in Chapter 2, Section 2.2.3 of this SEIS).

The HG Range noise contours would generate a Land Use Planning Zone covering approximately 213 acres (86 ha), about 128 acres (52 ha) in Zone 2, and about 26 acres (11 ha) in Zone 3. However, all of the acreage affected by HG Range noise contours remains within Andersen South and no people would be affected by this noise. Hand grenades generate blast noise and are expressed as C-weighted noise levels. Figure 5.1.4-2 shows the Noise Zones around the HG Range in Andersen South and Table 5.1.4-2 lists the associated acreage affected within each zone.

Table 5.1.4-2. Noise Exposure within Noise Zones under the Proposed Hand Grenade Range

Noise Zone (dB CDNL)	*Acres (ha)*		*Population*	
	On-base	*Off-base*	*Houses*	*People*
Land Use Planning Zone (57-62 dB CDNL)	213.2 (86)	0	0	0
Noise Zone 2 (62-70 dB CDNL)	128.4 (52)	0	0	0
Noise Zone 3 (>70 dB CDNL)	26.4 (11)	0	0	0
Total	**368 (149)**	**0**	**0**	**0**

Legend: dB = decibel; CDNL = C-weighted DNL; DNL = day-night average sound level.
Source: Army 2013; NAVFAC Pacific 2013.

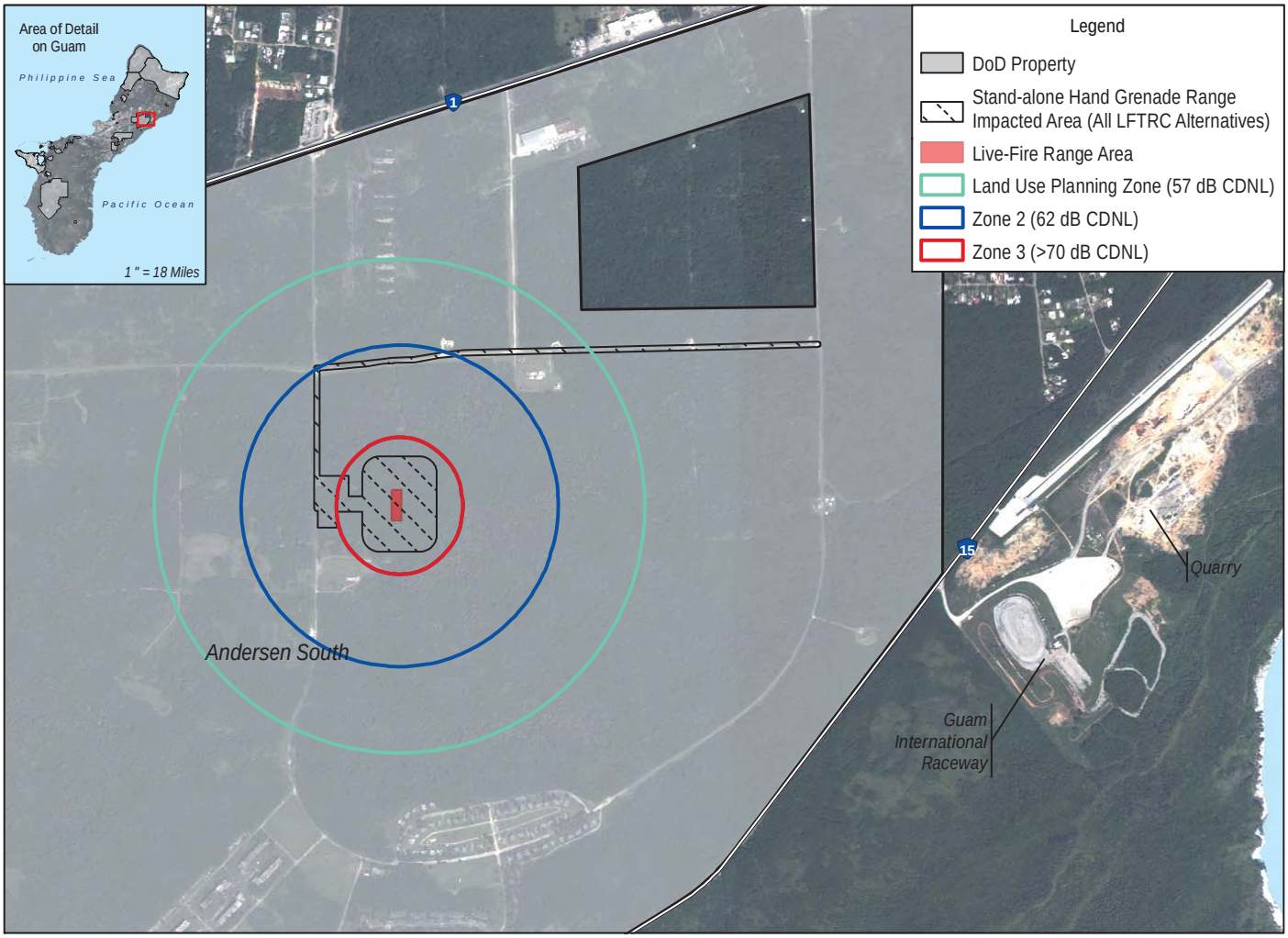


Figure 5.1.4-2
Hand Grenade Range CDNL Noise Zones Common to All Alternatives

Under this alternative, an estimated 22 homes and 88 people would be directly impacted by Zone 2 noise levels. Residential land use in Noise Zone 2 is normally considered incompatible unless mitigation can be implemented to reduce noise levels inside homes. Because there would be additional people exposed to incompatible noise levels and because the estimated noise would conflict with Marine Corps land use planning guidance for residential areas, these direct, long-term impacts would be considered significant. Other direct noise impacts, such as potential hearing loss, would not occur because maximum ADNL is below 75 dB ADNL. Indirect impacts due to noise such as decreases in job performance and inauditory health effects are widely debated but there are no unambiguous studies indicating that performance and inauditory health effects would occur below maximum ADNL levels of less than 75 dB (Department of Defense Noise Working Group 2009). Potential mitigation measures to reduce noise impacts include maintaining/enhancing dense foliage and/or constructing berms between the range and the residences. Doing so has the potential to decrease noise levels by 6 dB, thereby mitigating impacts to most of the residences to less than significant (U.S. Army Center for Health Promotion and Preventive Medicine 2010). If this alternative is chosen for implementation, a detailed noise reduction plan would be developed to reduce impacts to below significant levels.

Alternative 1 is the only proposed LFTRC alternative that would result in potentially significant impacts. However, these impacts could potentially be mitigated to less than significant through the use of berms and natural foliage, as described above.

5.1.5 Airspace

5.1.5.1 Affected Environment

Guam Air Route Traffic Control Center

The current airspace structure for Guam is covered by the Guam ARTCC. The Guam ARTCC is one of 22 FAA en route air traffic control facilities in the U.S. and its territories, and it serves a large area that is part of the Oakland Center Flight Information Region. Guam ARTCC airspace is essentially a 250-nautical mile (463 km) circle with Guam at its center, and is based on the radar coverage available from the radar site on Mount Santa Rosa, Guam.

The existing airspace structure for Guam consists of Class D, Class E, SUA and ATCAAs. Class D airspace is associated with AAFB and Guam International Airport. It includes the airspace within a 4.3-nautical mile (8 km) radius around each airfield and extends from the surface to 2,600 feet (792 m) MSL.

Class E airspace encompasses all other undesignated airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. If an aircraft is flying on a federal airway below flight level (FL) 180 (18,000 feet [5,486 m] MSL), it is in Class E airspace. Class E airspace is also the airspace used by aircraft transiting to and from the terminal (e.g., an airport) or en route beginning from 14,500 feet (4,420 m) AGL to FL180. Class E airspace ensures IFR aircraft remain in controlled airspace when approaching aircraft outside Class D airspace or when flying on "Victor Airways," which are federal airways below 18,000 feet (5,486 m) MSL. VFR aircraft can fly up to 17,500 feet (5,334 m) AGL if they can maintain VFR weather clearance criteria and the aircraft is equipped to fly at 17,500 feet (5,334 m) AGL.

The Guam ARTCC facility and the FAA regional offices are situated at Guam International Airport. The major airfields on Guam (i.e., Guam International Airport and AAFB) are within 10 nautical miles (18.5 km) of each other. The Guam ARTCC provides approach and departure services for airports within

Guam ARTCC airspace and control of aircraft flying through ARTCC airspace. Radio aids to navigation on Guam include one VHF Omni directional Radio Range-Tactical Air Navigation (Nimitz), one at AAFB, and two non-directional beacons (Mount Macajna and Rota). Rota International Airport, Tinian International Airport, and Saipan International Airport, all within 130 miles (209 km) of Guam, serve as suitable alternate airports for aircraft bound for Guam International Airport or AAFB.

Guam International Airport

Guam International Airport is the only civilian air transportation facility on Guam. The airport's two parallel runways are oriented northeast to southwest. Runway (RWY) A24 left (RWY 24L) and 06 right (RWY 06R) and Runway 24 right (RWY 24R) and 06 left (RWY 06L) are 10,015 feet (3,053 m) and 10,015 feet (3,052 m) in length, respectively. Guam International Airport has Class D airspace (Figure 5.1.5-1), and has continuous operations (i.e., 24 hours per day). The Class D airspace extends from the surface upward to and including 2,600 feet (792 m) MSL within a 4.3 nautical miles (7.9 km) radius of Guam International Airport. Based on the 10 nautical miles (19 km) distance between Guam International Airport and AAFB, there is approximately 1 nautical mile (1.9 km) of separation between the Class D airspace associated with each airport.

There are 14 published instrument procedures supporting Guam International Airport, including Instrument Landing Systems (ILS) or LOC RWY 06L, ILS or LOC RWY 06R, RNAV (GPS) Y RWY 06L, RNAV (GPS) Y RWY 06R, RNAV (GPS) Y RWY 24L, RNAV (GPS) Y RWY 24R, RNAV (RNP) Z RWY 06L, RNAV (RNP) Z RWY 06R, RNAV (RNP) Z RWY 24L, RNAV (RNP) Z RWY 24R, VOR/DME OR Tactical Air Navigation RWY 06L, Tactical Air Navigation RWY 24R, VOR-A, and non-directional beacon/DME RWY 24R.

Detailed information on civilian air traffic associated with Guam International Airport is provided in the 2010 Final EIS (Volume 2, Chapter 7: Airspace, Section 7.1.3: Civilian Air Traffic, pages 7-10 to 7-11).

Andersen Air Force Base

Andersen Tower's Class D Airspace is within a 4.3 nautical miles (7.9 km) radius of the Airport Reference Point (1335.04N/14455.80E) of AAFB, from the surface up to and including 2,600 feet (792 m) MSL (see Figure 5.1.5-1). Andersen Tower and Airfield Management Operations is open 24 hours a day, 365 days a year.

AAFB contains two airfields: one main, base-proper airfield (North Field) and NWF airfield. Airspace over AAFB North Field supports flight operations including takeoffs, landings and traffic pattern training of all types of aircraft up to and including B-52s, C-5s, C-17s, MH-60s, and KC-135s. There are eight instrument procedures supporting AAFB: ILS OR LOC/DME RWY 24L, ILS OR LOC/DME RWY 24R, ILS OR LOC/DME RWY 06L, ILS OR LOC/DME RWY 06R, TACAN RWY 06L, TACAN RWY 06R, TACAN RWY 24L, and TACAN RWY 24R. Detailed information on military air traffic associated with AAFB is provided in the 2010 Final EIS (Volume 2, Chapter 7: Airspace, Section 7.1.2: Military Air Traffic, pages 7-8 to 7-10).

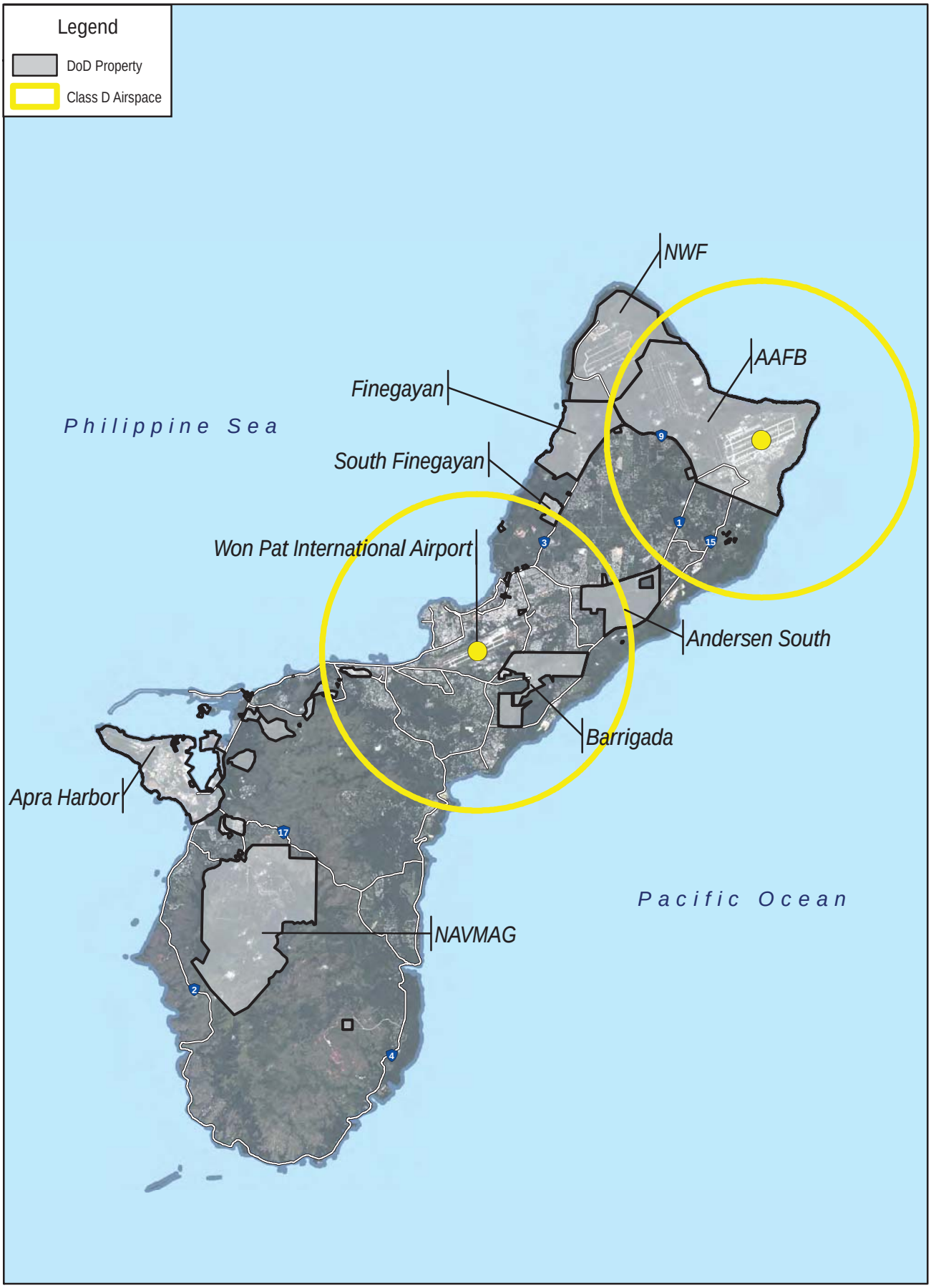


Figure 5.1.5-1
Guam International Airport and Andersen AFB
Class D Airspace

Military Aviation Training Areas

Existing SUA in the region consists of W-517 and R-7201 (Figure 5.1.5-2). W-517 is a Warning Area that overlays deep ocean water located approximately 50 miles (80 km) south-southwest of Guam and is constrained by high altitude jet routes converging over Guam that run to the east and west of the Warning Area. R-7201 is the Restricted Area surrounding Farallon de Medinilla (3-nautical mile [5.6-km] radius) with altitudes from the surface to unlimited and encompasses 28 square nautical miles (96 square km).

A Restricted Area is a type of SUA that is identified as an area within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within Restricted Areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities, or both. Restricted Areas denote the existence of unusual hazards to aircraft such as artillery firing, aerial gunnery, small arms fire, or guided missiles. Penetration of Restricted Areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. A Warning Area is airspace of defined dimensions, extending 3.0 nautical miles (5.5 km) outward from the shoreline that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such Warning Areas is to warn nonparticipating pilots of the potential danger. A Warning Area may be located over domestic or international waters or both.

ATCAA is airspace of defined vertical and lateral limits assigned by the FAA. ATCAA areas are established for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic. There are open ocean ATCAAs within the Guam and CNMI region used for military training activities, from unit level training to major joint exercises. ATCAAs 1, 2, 3, 5, and 6 as depicted in Figure 5.1.5-2 have been pre-assigned in agreements with Guam ARTCC, COMNAV Marianas, and the Commander, 36th Wing, AAFB.

The ATCAAs are activated for short periods to cover the timeframes of training activities. ATCAA-6 overlies Guam and has an altitude structure of FL 390-430. Data available from FY 2009 indicate that ATCAA 6 was used a total of 381 hours over 61 days by a mix of aircraft including B-52, KC-130, KC-135, and B-2. This usage is based on a long-term agreement that is still in effect and would not substantially change over time.

A Controlled Firing Area (CFA) is airspace designated to contain activities that if not conducted in a controlled environment could be hazardous to nonparticipating aircraft. CFAs provide a means to accommodate certain hazardous activities that can be immediately suspended if a nonparticipating aircraft were to approach the area.

5.1.5.2 Environmental Consequences

Construction

No changes to airspace would be required during construction of the LFTRC under Alternative 1, and construction activities would not be expected to conflict or interfere with the use or management of existing airspace in the vicinity. Therefore, construction of the LFTRC under Alternative 1 would have no impact on airspace.

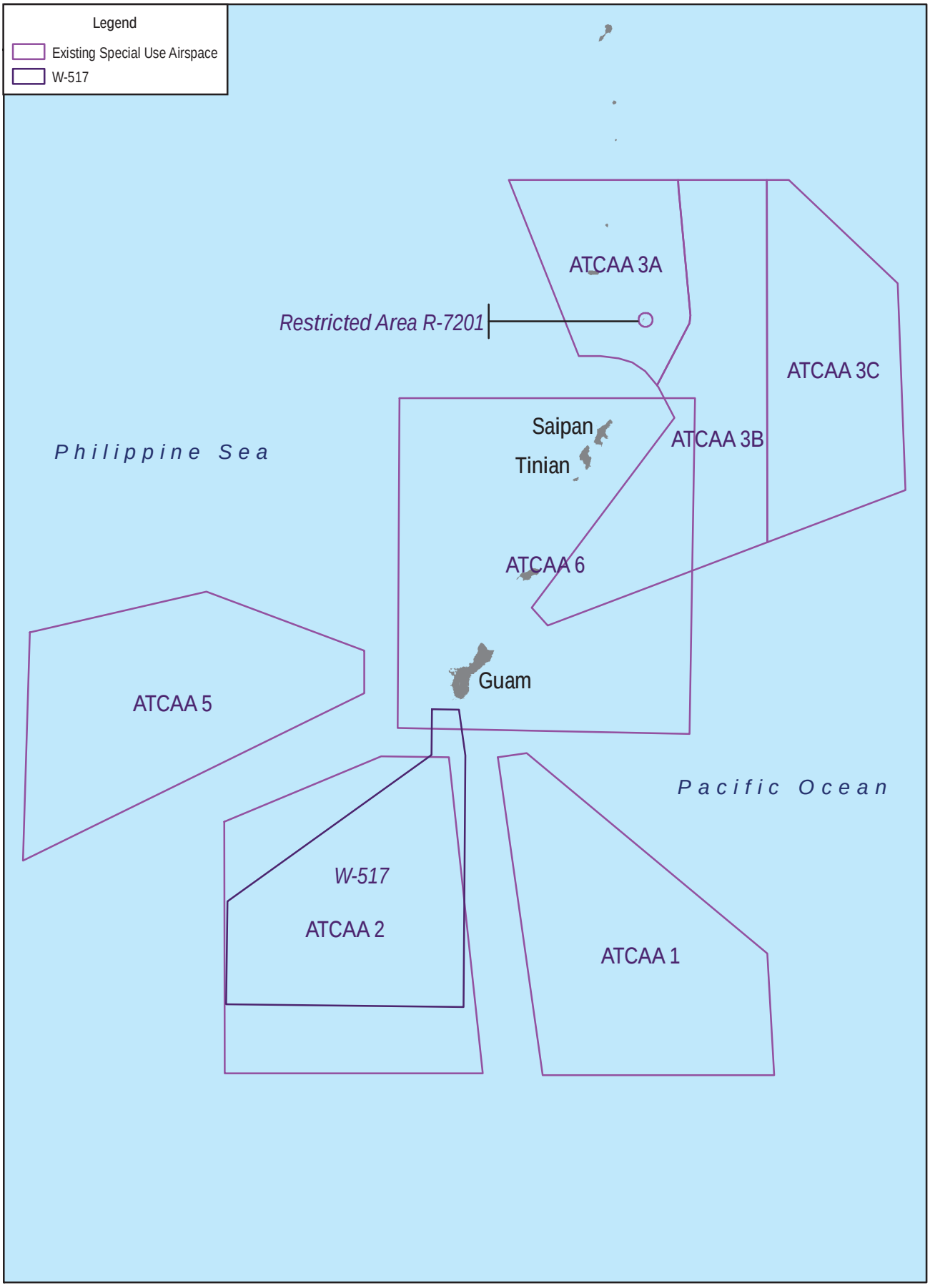


Figure 5.1.5-2
Existing SUA within Guam ARTCC Airspace

Operation

Figure 5.1.5-3 depicts the proposed Restricted Area associated with the Alternative 1. This SUA would be needed to contain the vertical hazard associated with the proposed live-fire training. Boundary coordinates for the proposed Andersen South/Plateau Primary Option of R-7202 Guam would begin at:

- lat.13°31'28"N., long.144°53'6"E
- to lat.13°29'47"N., long.144°55'55"E
- to lat.13°28'3"N., long.144°55'0"E
- to lat.13°28'48"N., long.144°53'5"E
- to lat.13°29'48"N., long.144°52'15"E
- to the point of beginning

Altitudes for this Restricted Area SUA would be from the surface to 3,000 feet (914 m) above ground level. Activation of proposed R-7202 would occur when live-fire includes weapons with vertical hazard values, which may pose a threat to non-participating aircraft. Live-fire training is estimated to occur 39 weeks per year. Times of use would typically be between 6:00 a.m. and 7:00 p.m. local time. On average, the planned use of the airspace would fall within the charted "times of use." However, a DoD requirement exists for planned live-fire range use during hours of darkness. As a result, it is anticipated that a minimum of 15% of the range use would be outside of typical daily times. Night training is estimated to occur twice per week during the qualification periods and would require consecutive firing days.

The Controlling Agency for the proposed R-7202 would be FAA Guam and the Using Agency would be Commander, Joint Region Marianas.

In addition to the LFTRC, an HG Range would be located at Andersen South. This range would be common to all LFTRC alternatives. Figure 5.1.5-4 depicts the proposed CFA associated with the use of the HG Range at Andersen South for all LFTRC alternatives. Activities conducted within the proposed CFA may include live-fire HG employment to include basic employment and safe operation, as well as employment of HG in an urban environment. The times of use for the proposed CFA would be 7:00 a.m. to 12:00 p.m. local time, 2 to 3 times per week. Similar to the proposed R-7202, the Controlling Agency for the proposed CFA would be FAA Guam and the Using Agency would be Commander, Joint Region Marianas. Safety procedures would be implemented to ensure the safety of civilian aviation. Such procedures would include, but would not be limited to, posting range regulations with detailed operating procedures, and real-time communications with air traffic control and range clearance personnel.

Section 3.5.3.1 identifies the potential impacts to airspace from implementation of the LFTRC alternatives. The FAA stated in the preliminary Airspace Feasibility Assessment (FAA 2013) that Alternative 1, while not preferred, is feasible with the appropriate mitigation.

Operational activities under Alternative 1 have the potential for significant direct impacts to aviation due to the following:

- Guam International Airport airspace and instrument approach procedures.
- Standard Instrument Departures and Standard Terminal Arrivals.
- IFR/VFR traffic flows and terminal operations.
- Known but uncharted high volume routes.
- Existing SUA/Terminal Radar Service Area.
- VFR Reporting Points.



Figure 5.1.5-3
Proposed SUA Associated with LFTRC Alternative 1

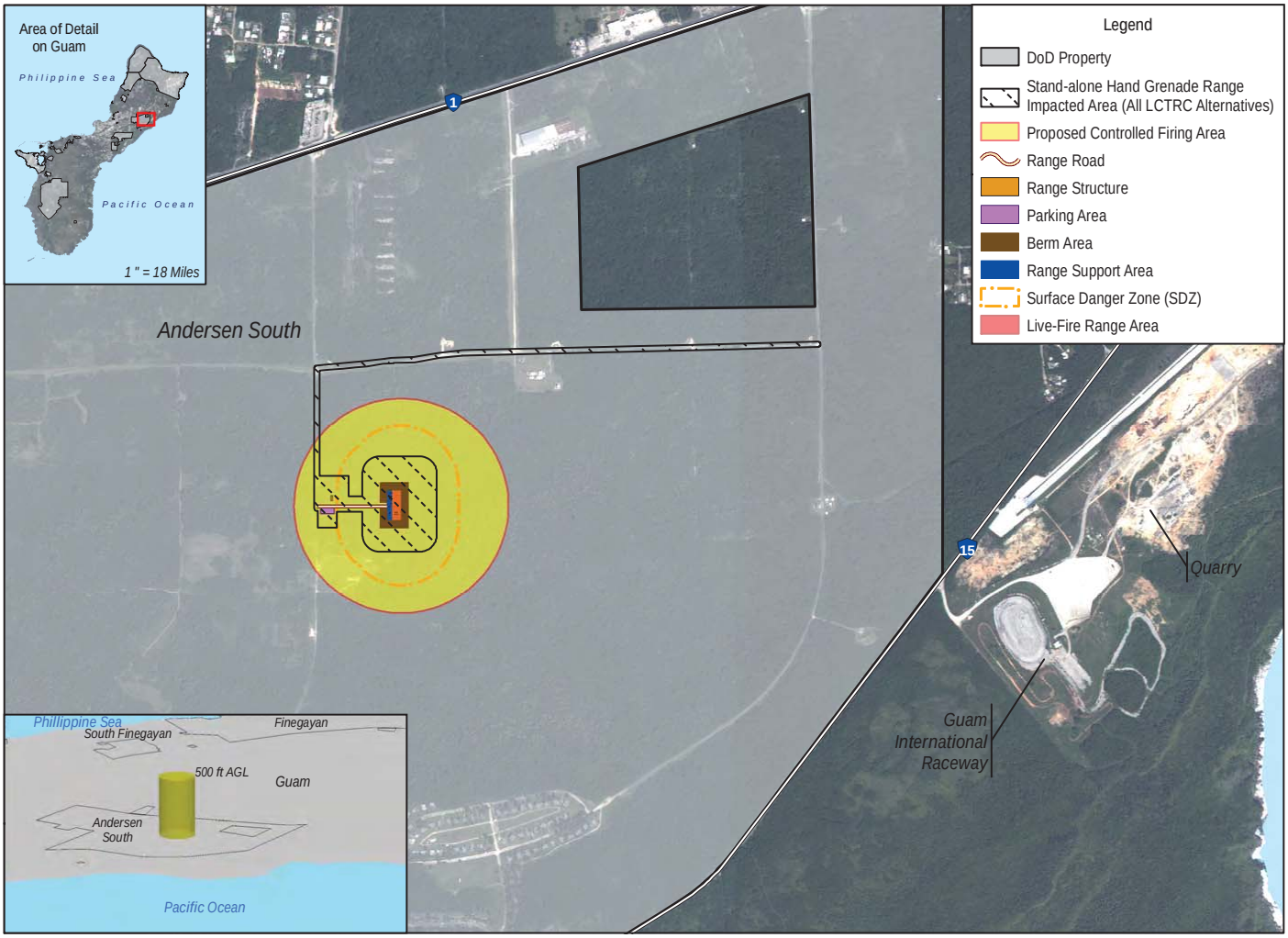


Figure 5.1.5-4
Hand Grenade Range Proposed Controlled Firing Area Common to All LFTRC Alternatives

However, if this alternative is selected, long-term impacts and potential mitigation would be further studied through the DON/FAA/Air Force consultation process. The general types of potential mitigation measures that could be employed may include adjusting airspace through FAA coordination. However, no specific potential mitigation measures are proposed at this time.

As detailed in Table 5.7-1, operational impacts under Alternative 1 would be the same as under Alternatives 2, 3, and 4. Operational impacts under this Alternative would be greater than impacts under Alternative 5.

5.1.6 Land and Submerged Land Use

5.1.6.1 Affected Environment

Andersen South land ownership and land use is as described in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.1.3.1, Andersen South, pages 8-32 to 8-34) and shown on Figure 5.1.6-1. The Route 15 LFTRC alternative affected environment is similar to the 2010 Final EIS Route 15 Range Alternative A. It would include the southeast portion of Andersen South (federally owned), the realignment of a segment of Route 15 (GovGuam-owned) to the interior of Andersen South and the federal acquisition of GovGuam land (Figure 5.1.6-1). The SDZs would extend into the Pacific Ocean and GovGuam submerged lands (Figure 5.1.6-1). All proposed LFTRC alternatives include a HG Range within Andersen South (Figure 5.1.6-1).

The current land use at Andersen South is generally vacant and naturally vegetated. There is vacant housing that has been used for military operations on urban terrain training. In addition, there is a water pump station and five wells with well protection areas, as shown on Figure 5.1.6-1. The planned land use for Andersen South, as described in the 2010 Final EIS, is non-live fire training. The land use adjacent to Andersen South and closest to the HG Range is Residential (based on a review of aerial photographs), and the planned land use is Very Low Density Residential (Figure 5.1.6-1).

The land proposed for acquisition is undeveloped and in its natural state, except for the following land uses: Guam International Raceway, quarry (Hawaiian Rock), pre-development site clearing, and roads. Less than 1% of the area is used for subsistence farming (Appendix D, SIAS, Table 5.3-1, Figure 5.3-3). No residences were identified within the land acquisition area. Planned land use for the acquisition area is primarily Park/Open Space with a small area of Residential in the southwest, and Very Low Residential northwest of Route 15 and Guam International Raceway (Figure 5.1.6-1).

The land adjacent and south of Route 15 was identified by USDA and the Guam Department of Agriculture as important farmland (see Figure 3.6.1-2 in Chapter 3 of this SEIS, and Figure 5.1.6-1), but the more recent land use plans do not identify future agricultural use in the area.

Land uses adjacent to the proposed Route 15 LFTRC include the planned non-live fire training to the west at Andersen South and submerged lands to the east. Pacific International operates a quarry north of the land acquisition area and east of Route 15. A residential community is located north of the International Raceway Park and Route 15. Vacant lands are adjacent to the northeast and southwest of the proposed land acquisition area (Figure 5.1.6-1).

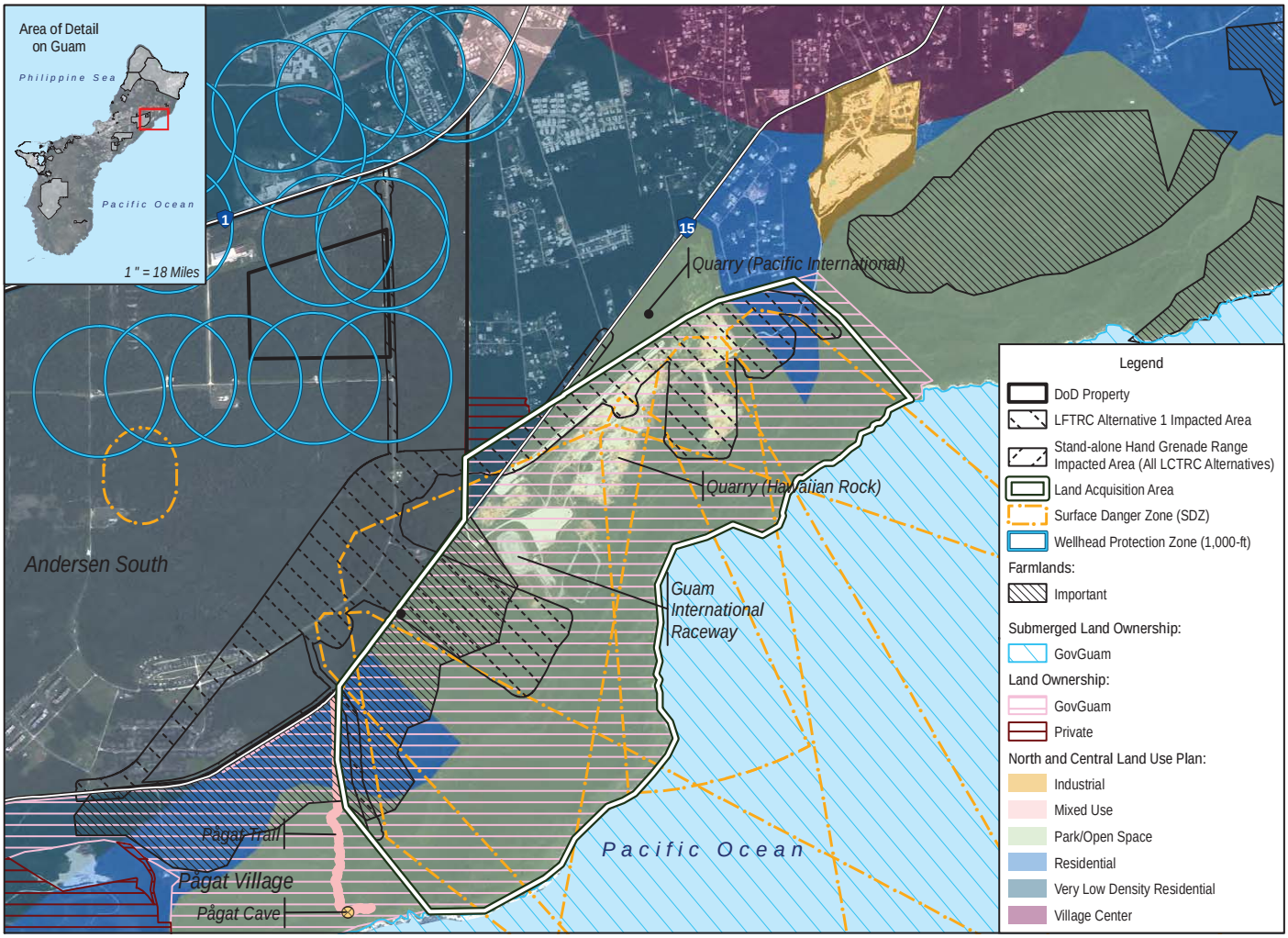


Figure 5.1.6-1
Land Use in the Vicinity of Route 15 LFTRC Alternative 1

The Pågat Trail is aligned along the southwestern edge and outside of the acquisition area. Pågat Cave and Pågat Village are located outside the acquisition area on the coast. Residential land use was identified west of the Pågat Trail and south of Andersen South. Planned land use for the vicinity of the land acquisition area is Very Low Residential to the north, and Park/Open Space and Residential to the northeast and southwest (see Figure 5.1.6-1). Sasayan Valley is located southwest of the acquisition area.

The utility infrastructure improvements for potable water, wastewater, electrical and IT/COMM (on-site) would be within the proposed land acquisition area or existing federal lands. No new easements would be acquired.

5.1.6.2 Environmental Consequences

Land use impacts are addressed in this section. Land ownership impacts are addressed in Section 5.1.15, Socioeconomics and General Services.

Construction

As previously discussed in Chapter 3, Section 3.6.3.1 of this SEIS, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource under any of the alternatives.

Operation

The HG Range (common to all LFTRC Alternatives) would be located entirely within Andersen South. The hand grenade noise assessment methodology and predicted noise contour is presented in Section 5.1.4. Hand grenade noise is unique among the live-fire ranges in that it is characterized by CDNL and not ADNL. Noise Zone 2 (62-70 dB CDNL) is considered incompatible (subject to local zoning) with sensitive land uses (e.g., housing, schools, medical facilities). The nearest sensitive receptors are adjacent and north of Andersen South. The Noise Zone 2 contour lies within the Andersen South boundary and no impact on land use beyond the installation boundary is anticipated.

Any land use incompatibility issues related to the military mission within Andersen South would be resolved through application of installation master planning guidelines outlined in UFC 2-100-01. Therefore, land use impacts on Andersen South would be less than significant.

As described in Chapter 3, Section 3.6.3 of this SEIS, new access restrictions placed on non-DoD populations is a potentially significant adverse impact when access to or existence of a specific community-valued land or submerged land use would be affected. Guam International Raceway is a land use that is unique on Guam and valued in the community for recreational and socioeconomic reasons, as described in Sections 5.1.7 and 5.1.15, respectively. Because implementation of Alternative 1 would result in the direct loss of this raceway, there would be a short- and long-term adverse significant land use impact. The Chamorro Land Trust Commission (CLTC) license that allows the raceway to operate at the present location expires in 2018. Because it is unknown if the license would be renewed irrespective of the proposed action, no potential mitigation measures have been identified to offset the significant land use impact of implementing Alternative 1. In addition, Hawaiian Rock operates a quarry within the proposed LFTRC that would be precluded by the proposed action. The land lease would be terminated and there would be a significant impact on current land use.

There would be no land use impact on the Pacific International quarry, which is located outside of the LFTRC boundary (see Figure 5.1.6-1). With respect to agricultural land use, no USDA-designated prime farmland would be affected. Less than 1.5% of the USDA-designated important farmland would be impacted. The direct, long-term impact to farming would be less than significant because the planned land

use for the acquisition area does not include agricultural land uses. The major planned land use for the area is Park/Open Space, and most of the area would be maintained as open space.

There would be a direct, short- and long-term significant impact associated with new restrictions on public access to the coastal and submerged lands encumbered by the SDZs generated by LFTRC operations. Pågat Village, Cave, and Trail would not be impacted by this alternative. However, SDZs would extend over the Pågat Point cultural site, and public access would be restricted. Access to the submerged lands would be restricted when the ranges are in use, which may interfere directly with recreational activities or indirectly by altering the transit route to recreational sites. This would be a short- and long-term significant impact on submerged land use. The access restrictions would not impact the access to the two Fish Aggregating Devices located east of Guam (see Figure 3.6.1-1). The DoD would consider requests for access for special events (e.g., fishing tournaments) on a case by case basis.

Sensitive land uses are not recommended in Zone 3 (75-85 ADNL) noise contours. Zone 2 (65-74 ADNL) noise levels generated by the proposed LFTRC, excluding the HG Range at Andersen South, are considered incompatible (subject to local zoning) with sensitive land uses and are more suitable for industrial or agricultural uses. As shown on Figure 5.1.4-1 of Section 5.1.4, Noise, the Zone 3 noise contour would extend slightly beyond the proposed northern installation boundary into land that does not include residences. The Zone 2 noise contour for the LFTRC (excluding the HG Range) would also extend beyond the new range boundary into the civilian community. North of the proposed LFTRC there are existing residences within the Zone 2 contour (see Table 5.1.4-1), and the planned land use is Residential and Very Low Residential. Southwest of the proposed LFTRC is vacant land, but the planned land use includes Residential within the Zone 2 contour. The LFTRC noise levels would be incompatible with current and future land use beyond installation boundaries within the Zone 2 and 3 contours and is considered a long-term significant impact on land use. Potential mitigation for minimizing the direct impacts on noise levels are described in Section 5.1.4, Noise. Potential mitigation for land use incompatibilities may include regular DoD coordination with GovGuam on military noise and hazard area information derived from Joint Land Use Studies or Range/AICUZ plans or other studies. These studies or plans would inform future GovGuam zoning or land use decisions and minimize the potential for incompatible public or private development near military installations. Non-DOD potential mitigation would be the GovGuam updates to future community land use plans to address proposed DoD land uses.

The off-base utility infrastructure improvements would not impact existing or planned land uses because the proposed alignments would be on-base or within existing easements and utility corridors.

The significance of land use impacts resulting from implementation of Alternative 1 would be similar to that of Alternatives 2, 4 and 5; Alternative 3 is the only LFTRC alternative with less than significant land use impacts.

5.1.7 Recreational Resources

5.1.7.1 Affected Environment

A list of recreational resources near Alternative 1 is contained in the 2010 Final EIS (Volume 2, Chapter 9: Recreational Resources, Section 9.1.2.4: Non-Department of Defense Land and Section 9.1.3: Central, pages 9-4 to 9-11). In addition to the listed resources and activities, the area is popular with residents and visitors alike for spelunking and off-trail backcountry hiking activities at Pågat and Marbo Caves and the surrounding areas. Other recreational opportunities within the north region of Guam include trails, historic/cultural attractions, beaches/parks, scenic points, diving locations, and others (e.g., golf courses). These recreational opportunities include public and non-public facilities. Non-public

facilities include those contained within lands identified as military installation. Access and use of these facilities within federal lands is limited to installation personnel and their guests. Public recreational facilities are located on non-federal lands and include marine preserves. Routes 1, 3, 9, and 15 provide regional access to recreation opportunities within the north region. As previously discussed in Sections 5.1.4 and 5.1.6, Guam International Raceway is an important recreational resource. The Raceway is leased from the Chamorro Land Trust. Other notable recreational resources include Pågat Trail, Pågat Point, Pågat Cave and Village, Marbo Cave, Taguan Point Scenic Vista, Taguan Hiking Trail, Lujuna Point, and Lujuna Hiking Trail. Recreational resources within the vicinity of Alternative 1 are identified in Table 5.1.7-1.

Table 5.1.7-1. Recreational Resources within the Vicinity of Alternative 1

Recreational Resource	*Public Access*
Guam International Raceway	Open to the public
Marbo Cave	Open to the public
Pågat Trail	Open to the public
Pågat Cave and Village (and Cultural Site)	Open to the public
Taguan Trail (Mangilao Golf Course shoreline access)	Open to the public
Lujuna Trail	Open to the public

Source: DON 2010.

The Pågat Trail, Cave, and Village complex is an area of cultural and historical importance and "the coastal area is also a significant pre-historic site on the NRHP and has other unique geological features such as caves with fresh water" (GCMP 2011). As discussed in Section 3.10.2 of this SEIS, after signing the 2011 PA, the Marine Corps began evaluating options to satisfy the commitment to provide continued access to Pågat Village and Pågat Cave. With this access commitment in mind, the Alternative 1 would be designed to avoid impacting Pågat Village, Cave, and Trail, primarily through the redesigned and reduced footprint for the SDZs, both on land and over water. Lujuna Point and Lujuna Hiking Trail are located on Chamorro Land Trust property (GBSP 2013).

5.1.7.2 Environmental Consequences

As discussed in Section 1.1, ensuring access to Pågat Village and Cave, 24 hours a day, 7 days a week, reflects a formal commitment announced by the Under Secretary of the Navy in January 2011, in addition to being stated in the ROD for the 2010 Final EIS. The revised SDZs avoid direct impacts to Pågat Village, Pågat Cave and Pågat Trail, but still results in the closure of access to the Pågat Point cultural site, which would remain within the redesigned SDZs. And while the trail leading to Pågat Village and Cave would not directly connect with a realigned Route 15 (see Figure 2.5-2, Chapter 2 of this SEIS), the trail would still connect with the old Route 15 that would remain open to the trailhead.

The use of the proposed LFTRC would result in restricted access to some dive spots, fishing zones, and snorkeling areas for the public. Popular dive/snorkeling locations are mainly on the west (leeward) side of the island. Off-shore waters from the Route 15 alternative are generally rough and turbulent and are not ideal conditions for diving or snorkeling. Indirect short-term impacts from firing range noise are not expected to significantly lessen visitor enjoyment of recreational resources in the surrounding terrestrial or marine areas.

Implementation of this alternative would require the closure of Guam International Raceway and the acquisition or leasing of its parcel, resulting in direct, short- and long-term significant impacts to this recreational resource. As discussed in Section 3.7.3.3, the majority of comments received during scoping were related to the possible closure of Guam International Raceway, resulting from the selection of

Alternative 1 and the significant impacts anticipated by the community if that closure were to occur. There are no other raceways of this type on Guam that could be used in the event of the closure of Guam International Raceway.

Construction

Route 15 would be realigned inland to allow for land acquisition to accommodate the proposed range and SDZ configuration. This realignment process would require grading, grubbing, cutting, and filling. Direct, short-term impacts to recreational resources would result during the construction phase, primarily through possible vehicle delays in reaching recreational sites, caused by earth-moving and construction vehicles on Route 15 and peripheral roadways. Although staged construction equipment would not obstruct access to, or use of, recreational resources, short-term inconvenience to resource seekers (e.g., potential detours, longer wait, and other similar inconveniences) would result in direct, short-term less than significant impacts.

In addition to short-term impacts to other recreational resource access during construction, the commencement of the construction phase itself would require the permanent closure of the Guam International Raceway, resulting in a significant direct, long-term impact to this recreational resource.

Operation

While Pågat Village, Cave, and Trail would not be directly impacted by implementation of this alternative, SDZs would still extend over the Pågat Point cultural site and would represent a direct and indirect long-term significant impact to the public's access to this archeological area during Marine Corps training (see Section 5.1.6.2). Furthermore, this alternative would result in the closure of the Raceway. The loss of the Raceway would be considered a direct and long-term significant impact because this particular use would be discontinued and a similar use is not found elsewhere on Guam. Potential mitigation measures have not been identified to offset the significant impacts to recreational resources with implementation of Alternative 1.

5.1.8 Terrestrial Biological Resources

5.1.8.1 Affected Environment

Vegetation Communities

Figure 5.1.8-1 depicts the vegetation communities within the boundaries of the Route 15 lands and Andersen South. The vegetation communities were mapped based on the following sources:

- USFS (2006) - island-wide coarse-scale mapping used as the starting point.
- Field surveys conducted in 2008 and 2010 in targeted areas for more fine-scale mapping.
- 2011 aerial imagery - review of that imagery showed large areas of vegetation recently cleared near Guam International Raceway.

Vegetation types are described in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.1.1: Vegetation Communities, pages 10-1 to 10-6). The Route 15 LFTRC action area encompasses large areas of primary limestone forest on the upper plateau at cliff edges and on the coastal bench below the cliffline. Some forests on the upper plateau near the cliffline are growing on rugged limestone terrain of sharp pinnacles, towers, and narrow fissures and, as a result, are minimally disturbed by ungulates.

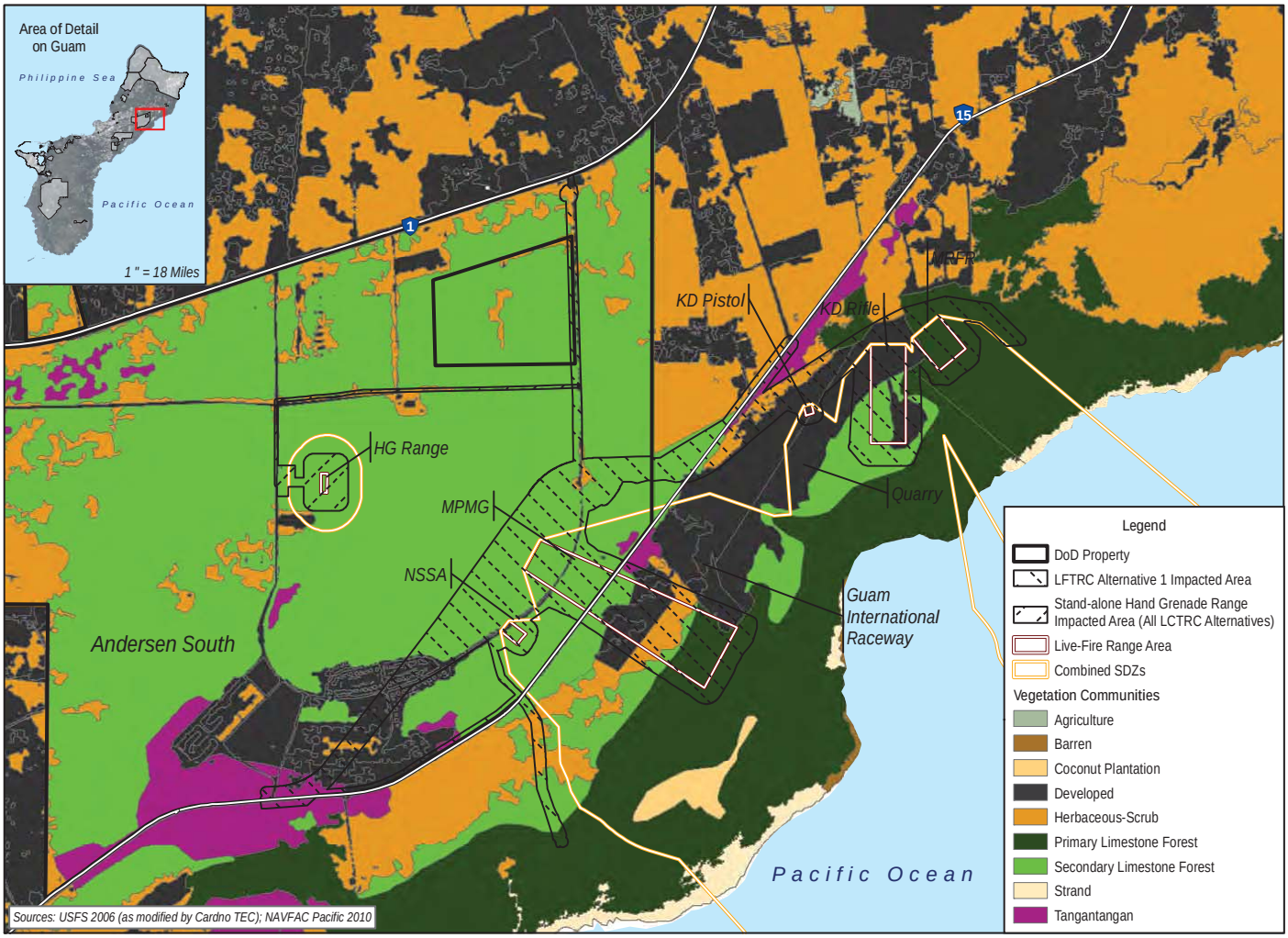


Figure 5.1.8-1
Vegetation Communities - Route 15 LFTRC Alternative

Terrestrial Conservation Areas

The Route 15 LFTRC action area does not contain any designated terrestrial conservation areas.

Wildlife - Native Species

No new information is available for the Route 15 and Andersen South areas since the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Sections 10.1.4.1: Andersen South and 10.1.4.2: Non-DoD Land, pages 10-52 to 10-59). Native wildlife species within the project area include the yellow bittern, blue-tailed skink, and mourning gecko, which are common throughout Guam. Non-native species reported in the 2010 Final EIS include feral pigs, Philippine deer, and various amphibians and reptiles, including the brown treesnake, that are common on Guam.

Special-Status Species: Federal ESA-Listed and Proposed Species

One federal ESA-proposed species (Mariana eight-spot butterfly) occurs within the proposed Route 15 LFTRC alternative (Table 5.1.8-1 and Figure 5.1.8-2). Although "suitable habitat" for special-status species is present within the Alternative 1 project areas, the brown treesnake, the primary factor in the extirpation of special-status wildlife species on Guam and one of the largest obstacles to achieving recovery of special-status species, is still considered abundant and widespread on Guam. Until brown treesnakes are suppressed or removed from at least targeted areas on Guam, the habitat is not in a suitable condition to support the survival of special-status species due to current snake abundance on Guam (e.g., Guam Micronesian kingfisher, Guam rail, Mariana crow) (USFWS 2010a).

Table 5.1.8-1. Distribution of Special-Status Species at the Route 15 LFTRC Alternative and Andersen South

Name	*Status**		*Habitat*	*Known to Occur*	*Comments*
	ESA	*Guam*			
Mammals					
Mariana fruit bat[a, c, i, k, m, o, g]	T	E	Limestone forest, ravine forest, *Casuarina*, and coconut plantations.	No	Last observation in 1999 along coastal cliffline of Route 15 lands; recovery habitat present.
Birds					
Mariana swiftlet[a, b, k, m, o]	E	E	Nests in caves; forages over grasslands and forests.	No	Last observation in 1998 along coastal cliffline; one nest/roost cave in the area that was abandoned in late 1970s.
Mariana crow[a, c, e, k, m, o, s]	E	E	All forests with a preference for native limestone forest.	No	Extirpated from Guam - last seen within Route 15 lands in the 1970s and on AAFB in 2012; recovery habitat present.
Guam rail[c, j, k, m, n]	E	E	Secondary habitats, some use of savanna and limestone forests.	No	Extirpated from the wild on Guam by 1985; recovery habitat present.
Guam Micronesian kingfisher[c, m, t]	E	E	Forest and scrub with a preference for native limestone forest.	No	Extirpated from the wild on Guam by 1988; recovery habitat present.
Reptiles					
Slevin's skink[u]	PE	E	Mid-elevation closed humid and montane forests.	No	NR during 2010 and 2012 surveys; has not been recorded on Guam since 1945 and is believed to be extirpated from Guam.
Pacific slender-toed gecko[a, f, k, l]	-	E	Forest edge.	No	NR; not observed in 2008 surveys.
Moth skink[a, f, k, l]	-	E	Forest areas with large tree trunks.	No	NR; not observed in 2008 surveys.

Table 5.1.8-1. Distribution of Special-Status Species at the Route 15 LFTRC Alternative and Andersen South

Name	*Status**		*Habitat*	*Known to Occur*	*Comments*
	ESA	*Guam*			
Invertebrates					
Mariana eight-spot butterfly[(h, l, o, p, q, u)]	PE	-	Intact limestone forest with host plant species.	Yes	Adults/larvae/eggs observed in 2008, 2009, and 2013 surveys; host plants present.
Mariana wandering butterfly[(p, r, u)]	PE	-	Larvae feed on one known host plant species found in native limestone forest habitat.	No	Has not been seen on Guam since 1979 and considered extirpated; host plants observed within impacted areas of Route 15 lands.
Guam tree snail[(a, d, f, k, l, o, p, u)]	PE	E	Cool shaded forested areas with high humidity.	No	NR; not observed in 2008, 2009, and 2013 surveys; no known individuals within project areas.
Plants					
Serianthes tree[(c, f, m, k, o, p)]	E	E	Limestone and ravine forests.	No	NR during 2010, 2012 and 2013 surveys; no known individuals within project areas; recovery habitat present.
Heritiera longipetiolata[(a, f, k, o, p, u)]	PE	E	Limestone forest.	Yes	Present southeast of Guam International Raceway.
Tabernaemontana rotensis[(l, u, v)]	PT	SOGCN	Limestone forest.	No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Cycas micronesica[(l, u, v)]	PT	SOGCN	Limestone forest, ravine forest, and savanna summits.	No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Bulbophyllum guamense[(l, u, v)]	PE	-	Lowland/limestone forests.	No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Dendrobium guamense[(u)]	PE	-	Lowland/limestone forests.	No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Eugenia bryanii[(l, u, v)]	PE	-	Windy exposed coastal clifflines in lowland/ limestone forests.	No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Maesa walkeri[(l, u, v)]	PE	-	Lowland/limestone forests.	No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Nervilia jacksoniae[(l, u, v)]	PE	-	Lowland/limestone forests.	No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Psychotria malaspinae[(l, u, v)]	PE	-	Lowland/limestone forests.	No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Solanum guamense[(l. u. v)]	PE	-	Lowland/limestone forests.	No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Tinospora homosepala[(l, u, v)]	PE	-	Lowland/limestone forests.	No	NR during 2010 and 2012 surveys; no known individuals within project areas.
Tuberolabium guamense[(l, u, v)]	PE	-	Lowland/limestone forests.	No	NR during 2010 and 2012 surveys; no known individuals within project areas.

Legend: *****- = not listed, E = endangered, NR = not reported; PE = proposed endangered, PT = proposed threatened, T = threatened, SOCN = Species of Greatest Conservation Need.

Sources: [(a)]Wiles *et al.* 1995; [(b)]USFWS 1991; [(c)]USFWS 2010b; [(d)]Duenas, Camacho, and Associates 1999; [(e)]USFWS 2005; [(f)]GDAWR 2006; [(g)]Vogt and Farley 2013; [(h)]Campora and Lee 2009; [(i)]USFWS 2009a; [(j)]USFWS 2009b; [(k)]GovGuam 2009; [(l)]NAVFAC Pacific 2010; [(m)]USFWS 2011; [(n)]BirdLife International 2013; [(o)]JRM 2013; [(p)]UoG 2014; [(q)]USFWS 2012a; [(r)]USFWS 2012d; [(s)]USFWS 2009c; [(t)]USFWS 2008b; [(u)]USFWS 2014a, 2014b; [(v)]NAVFAC Pacific 2013a, 2013b.

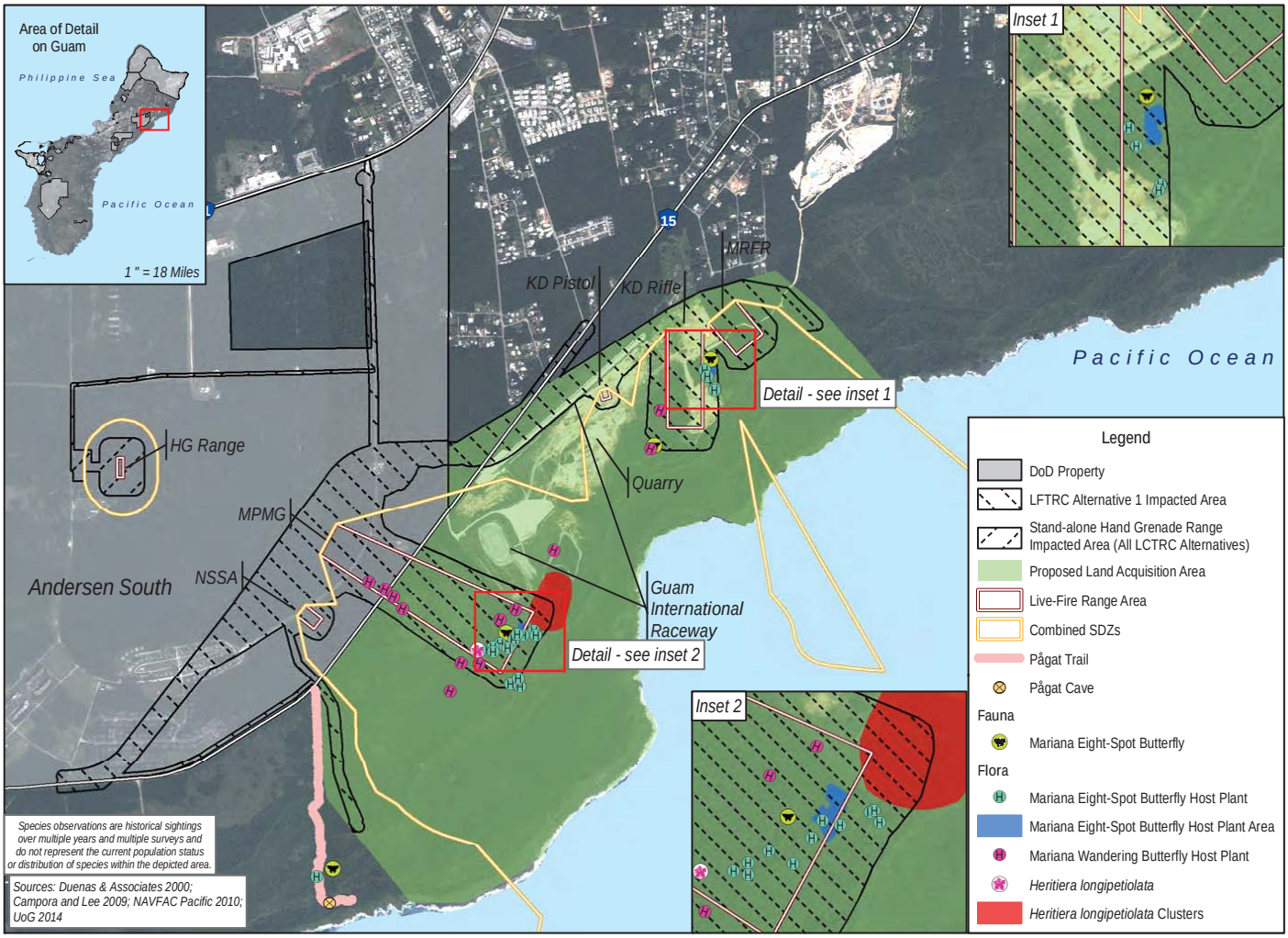


Figure 5.1.8-2
Special-Status Species Observations - Route 15 LFTRC Alternative

In addition to field surveys conducted in 2009 and 2010 in support of the 2010 Final EIS, field surveys for this SEIS were conducted in 2013 for Mariana fruit bats at Andersen South (Vogt and Farley 2013) and for federal ESA-proposed species at Andersen South and the Route 15 lands (UoG 2014).

MARIANA FRUIT BAT. The last recorded sighting in the Route 15 action area was of a single fruit bat in 1999 (Duenas & Associates 2000). Surveys in 2009 at Route 15 (NAVFAC Pacific 2010) and in 2013 at Andersen South (Vogt and Farley 2013) did not detect any bats. The closest known occurrence of fruit bats is on AAFB, more than 6 miles (9.7 km) to the north of the Route 15 LFTRC action area. While fruit bats are known to travel 6-7.5 miles (10-12 km) to reach forage areas (USFWS 1990, 2009a), and the cliffline along the Route 15 lands contains suitable fruit bat habitat, given the estimated very low numbers of fruit bats currently on Guam that are found only within AAFB and the NAVMAG (16 miles [26 km] to the south), it is unlikely that fruit bats would occur within the Route 15 LFTRC action area.

However, fruit bat recovery habitat is found within proposed project impacted areas on Route 15 lands (see Figure 3.8.3-1). Fruit bat recovery habitat was described by the USFWS in the BO for the Guam and CNMI Military Relocation (USFWS 2010a) and includes the following vegetation communities (based on vegetation mapping by the USFS [2006]) for foraging, roosting, and breeding: primary and secondary limestone forest, coconut plantation, ravine forest, and groves of ironwood.

MARIANA SWIFTLET. A nest/roost cave previously used by Mariana swiftlets is known from the Janum Springs area to the northeast of the proposed range area, but this cave was abandoned by the late 1970s (USFWS 1991). The last known occurrence of swiftlets within the Route 15 LFTRC action area was in 1998 when three individuals were observed along the coastal cliffline (GDAWR 1998). Surveys conducted in 2008 and 2009 for forest birds in support of the 2010 Final EIS did not record any incidental observations of Mariana swiftlets, although biologists did make concerted efforts to conduct early morning observations south of the abandoned nest/roost cave at Janum Springs (NAVFAC 2010). The only known occupied nest/roost caves on Guam are located on NAVMAG more than 16 miles (26 km) south of the Route 15 LFTRC action area. As swiftlets forage within 0.6-1.2 miles (1-2 km) of their nest/roost caves (Jenkins 1983), it unlikely that individuals from the only known population on Guam over 16 miles (26 km) away would occur within the Route 15 LFTRC action area. Therefore, as the Mariana swiftlet is not found within the impacted areas of Alternative 1, this species is not addressed further.

MARIANA CROW. The Mariana crow was last observed within the Route 15 lands in the 1970s (USFWS 2005). Since 2009, the population on Guam consisted only of two males on AAFB, occurring primarily within the MSA (USFWS 2009c). However, as of 2012, the Mariana crow is considered extirpated in the wild on Guam (Personal communication via letter from USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, HI regarding the DON NOI for Proposed Placement of LFTRC on Guam NWR; December 7, 2012). The closest population of crows is on the island of Rota, approximately 56 miles (90 km) north of Guam. Crows in northern Guam used primary limestone forest for nesting, with nests exclusively in native trees. They have been observed foraging in both primary and secondary limestone forests and tangantangan (USFWS 2005). Crow recovery habitat is found within proposed project impacted areas on Route 15 lands (see Figure 3.8.3-1).

GUAM RAIL. The Guam rail has been extirpated in the wild on Guam since 1985 and exists primarily in captivity on Guam and in mainland zoos. Experimental populations of Guam rails were introduced onto Rota, CNMI in 1989 and onto Cocos Island, off the southern coast of Guam, in 2011 (USFWS 2009b; BirdLife International 2013). The Guam rail prefers edge habitats, especially grassy or secondary vegetation areas that provide good cover; mature forest is deemed only marginal for the Guam rail

(USFWS 2009b). Guam rail recovery habitat is found within proposed project impacted areas on Andersen South and Route 15 lands (see Figure 3.8.3-2).

GUAM MICRONESIAN KINGFISHER. The Guam Micronesian kingfisher was extirpated in the wild by 1988 and is now found only in captivity on Guam and at mainland zoos (USFWS 2008b). Kingfishers utilized a wide variety of habitats including primary and secondary limestone forest, strand forest, coconut forest, edge habitats, and forest openings, but mature forests with tree cavities suitable for nesting may be an important requirement for kingfisher reproduction (USFWS 2008b). Kingfisher recovery habitat is found within proposed project impacted areas on Route 15 lands (see Figure 3.8.3-1).

SLEVIN'S SKINK. Originally found on Guam, Cocos Island, Rota, Tinian, Guguan, Alamagan, Asuncion, and Maug, it is now limited to Cocos Island, Sarigan, Guguan, Alamagan, Pagan, and Asuncion. Slevin's skink has not been recorded on Guam since 1945 and is believed to be extirpated from Guam; it is now known to occur only on Cocos Island (an atoll south of Guam) (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 1. Therefore, as Slevin's skink is not found within the impacted areas of Alternative 1, this species is not addressed further.

MARIANA EIGHT-SPOT BUTTERFLY. Two populations of the Mariana eight-spot butterfly have been reported in the Pågat area of the Route 15 lands. This butterfly is host-specific to the herbaceous plants *Procris pedunculata* and *Elatostema calcareum* (USFWS 2012a). During field surveys conducted for the 2010 Final EIS, several adult eight-spot butterflies and numerous host plant locations were observed within the Route 15 action area (Campora and Lee 2009) (see Figure 5.1.8-2). In July 2011, one adult male, one adult female, and nine eggs were located on the host plant *Procris pedunculata* near Guam International Raceway (Rubinoff and Kawahara 2011 as cited in USFWS 2012a). In 2013, surveys in the Route 15 project area observed eight-spot butterfly eggs, numerous chrysalis, and adults, and numerous clusters of host plants (UoG 2014).

MARIANA WANDERING BUTTERFLY. The Mariana wandering butterfly has not been seen on Guam since 1979 and is considered extirpated; a single remaining population occurs on Rota, CNMI (USFWS 2013). The only species known to be a Mariana wandering butterfly host plant (*Maytenus thompsonii*) is a common shrub of limestone forests on Guam and has been observed within the impacted areas on Route 15 lands (see Figure 5.1.8-2) (Moore and McMakin 2001; UoG 2014).

TREE SNAILS. The three proposed endangered tree snail species have not been reported within the Route 15 LFTRC action area (NAVFAC 2010; USFWS 2014b). Surveys conducted in 2008, 2009, and 2013 for the 2010 Final EIS and this SEIS did not observe the species within the Route 15 LFTRC action area. Therefore, as tree snails are not found within the impacted areas of the Route 15 LFTRC Alternative, these species are not addressed further.

SERIANTHES TREE. There are no records of the species within the impacted areas associated with Alternative 1. However, *Serianthes* recovery habitat is found within proposed project impacted areas on the Route 15 lands (see Figure 3.8.3-2).

HERITIERA LONGIPETIOLATA. This endemic tree is found on AAFB in crevices of rough limestone in primary limestone forest. A cluster of 22 mature trees and 184 seedlings of the *H. longipetiolata* tree were documented within the Route 15 lands near Guam International Raceway (Duenas & Associates 2000) (see Figure 5.1.8-2). In addition, one individual was observed along a survey transect southwest of this cluster (NAVFAC Pacific 2010).

TABERNAEMONTANA ROTENSIS. Surveys conducted in 2008 and 2009 for the 2010 Final EIS did not observe the species within the Route 15 LFTRC lands and there are no records of the species within the

impacted areas (NAVFAC Pacific 2010; USFWS 2014b). Therefore, as ***T. rotensis*** is not found within the impacted areas of Alternative 1, this species is not addressed further.

CYCAS MICRONESICA. The cycad is found in limestone forests throughout Guam, including AAFB, and is proposed as an endangered species under the ESA because of the Asian cycad scale insect that is devastating the species. Surveys conducted in 2008 and 2009 for the 2010 Final EIS did not observe the species within the Route 15 LFTRC lands and there are no records of the species within the impacted areas (NAVFAC Pacific 2010; USFWS 2014b). Therefore, as ***C. micronesica*** is not found within the impacted areas of Alternative 1, this species is not addressed further.

BULBOPHYLLUM GUAMENSE. An epiphyte in the orchid family, this species occurs in mat-like formations on tree branches of coastal lowland/limestone forests. Currently, there are 8 known occurrences on Guam totaling fewer than 250 individuals (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of the Route 15 LFTRC alternative (USFWS 2014b). Therefore, as ***B. guamense*** is not found within the impacted areas of Alternative 1, this species is not addressed further.

DENDROBIUM GUAMENSE. An epiphyte in the orchid family, this species occurs on tree branches of coastal lowland/limestone forests. Currently, there are 4 known occurrences on Guam with fewer than 250 individuals (USFWS 2014a, 2014b). Surveys conducted in 2008 and 2009 for the 2010 Final EIS did not observe the species within the Route 15 LFTRC lands and there are no records of the species within the impacted areas (NAVFAC Pacific 2010; USFWS 2014b). Therefore, as ***D. guamense*** is not found within the impacted areas of Alternative 1, this species is not addressed further.

EUGENIA BRYANII. A perennial shrub in the myrtle family, the species is known only from the island of Guam. Historically, ***E. bryanii*** is known from windy exposed coastal clifflines and along the Pigua River, in lowland/limestone forests. Currently, ***E. bryanii*** is known from 6 occurrences totaling fewer than 420 individuals (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of the Route 15 LFTRC alternative (USFWS 2014b). Therefore, as ***E. bryanii*** is not found within the impacted areas of Alternative 1, this species is not addressed further.

MAESA WALKERI. A shrub or small tree in the primrose family typically found in limestone forests, this species is known from only two individuals on Guam – one individual on Mt. Lamlam and one individual on Mt. Almagosa (USFWS 2014a). There are no records of the species within the impacted areas of the Route 15 LFTRC alternative (USFWS 2014b). Therefore, as ***M. walkeri*** is not found within the impacted areas of Alternative 1, this species is not addressed further.

NERVILIA JACKSONIAE. A small herb in the orchid family, this species is found in lowland/limestone forests. On Guam, ***N. jacksoniae*** is known from 2 occurrences totaling fewer than 200 individuals: 1 occurrence near the UoG campus and 1 occurrence to the northwest of Tarague Beach (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of the Route 15 LFTRC alternative (USFWS 2014b). Therefore, as ***N. jacksoniae*** is not found within the impacted areas of Alternative 1, this species is not addressed further.

PSYCHOTRIA MALASPINAE. A shrub or small tree in the coffee family, this species is found in lowland/limestone forests. Currently, ***P. malaspinae*** is known from five occurrences: one individual at Ritidian Point within the Guam NWR, one individual at Pågat Point, one individual at the base of Mt. Almagosa, and two individuals at NWF (USFWS 2014a, 2014b). None of these individuals have been observed within the last 5 years. A specimen collected from the Ritidian NWR in August 2013 is currently pending identification (USFWS 2014a). There are no records of the species within the impacted

areas of the Route 15 LFTRC alternative (USFWS 2014b). Therefore, as *P. malaspinae* is not found within the impacted areas of Alternative 1, this species is not addressed further.

SOLANUM GUAMENSE. A small shrub in the nightshade family that occurs within limestone forests. Currently, *S. guamense* is known from a single occurrence of one individual on Guam (USFWS 2014a). There are no records of the species within the impacted areas of the Route 15 LFTRC alternative (USFWS 2014b). Therefore, as *S. guamense* is not found within the impacted areas of Alternative 1, this species is not addressed further.

TINOSPORA HOMOSEPALA. A vine in the moonseed family found in limestone forests. Currently, *T. homosepala* is known from 3 occurrences totaling approximately 300 individuals: 1 occurrence on the western side of Asan Ridge; 1 occurrence near the War in the Pacific Historical Park; and 1 occurrence on the cliff face at Hagåtña (USFWS 2014a). There are no records of the species within the impacted areas of the Route 15 LFTRC alternative (USFWS 2014b). Therefore, as *T. homosepala* is not found within the impacted areas of Alternative 1, this species is not addressed further.

TUBEROLABIUM GUAMENSE. An epiphyte in the orchid family found in limestone forests. Currently, *T. guamense* is known from three occurrences on Guam: two occurrences within the NAVMAG and one in the northeastern area of Finegayan (NAVFAC Pacific 2010; USFWS 2014a, 2014b). There are no records of the species within the impacted areas of the Route 15 LFTRC alternative (USFWS 2014b). Therefore, as *T. guamense* is not found within the impacted areas of Alternative 1, this species is not addressed further.

Special-Status Species: Guam-Listed Species and Species of Greatest Conservation Need (SOGCN)

MOTH SKINK AND PACIFIC SLENDER-TOED GECKO. The moth skink and Pacific slender-toed gecko have not been reported from the Andersen South or Route 15 lands based on surveys conducted in support of the 2010 Final EIS (NAVFAC Pacific 2010). The closest known occurrence of both species is within central and western AAFB, more than 6 miles (9.7 km) to the north of the Alternative 1 action area. The lack of a continuous corridor of suitable habitat linking the Route 15 LFTRC action area and the known occurrences on AAFB, allowing for these species to move between areas, makes it unlikely that the species would occur within the Route 15 LFTRC action area. Therefore, as the moth skink and Pacific slender-toed gecko are not found within the impacted areas of the Route 15 LFTRC Alternative, these species are not addressed further.

5.1.8.2 Environmental Consequences

Construction

Vegetation. Under Alternative 1, 65 acres (26 ha) of primary limestone forest and 190 acres (77 ha) of secondary limestone forest would be removed during proposed construction activities of the LFTRC under Alternative 1 (Table 5.1.8-2; see Figure 5.1.8-1). In addition, 104 acres (42 ha) of currently developed areas and 47 acres (19 ha) of herbaceous scrub/grassland and tangantangan would be impacted (Table 5.1.8-2).

Table 5.1.8-2. Direct Impacts to Vegetation Communities with Implementation of LFTRC Alternative 1

Project Component	*Vegetation Community (acres [ha])*					
	PLF	***SLF***	***HS***	***TT***	***Dev***	***Total***
Range Areas, Associated Features, and Route 15 Realignment (at Route 15)	65.4 (26.5)	170.5 (69.0)	33.8 (13.7)	11.0 (4.5)	102.5 (41.5)	**383.2 (155.1)**
HG Range (at Andersen South)	0	19.4 (7.9)	1.8 (0.7)	0	1.8 (0.7)	**23.0 (9.3)**
Total	**65.4 (26.5)**	**189.9 (76.9)**	**35.6 (14.4)**	**11.0 (4.5)**	**104.3 (42.2)**	**406.2 (164.4)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; TT = tangantangan; Dev = developed.

Native limestone forest, both primary and secondary, has been significantly reduced on Guam due to past and ongoing actions including extensive disturbance during and after WWII, widespread planting of non-native species; and impacts from non-native ungulates; development; fire; and deforestation. As stated in Section 3.8.1.1, limestone forests on Guam are important since they retain the functional ecological components of native forest that provide habitat for the majority of Guam's native species, including ESA-listed, ESA-proposed, and Guam-listed species and Guam SOGCN, as well as maintaining water quality and reducing fire risk. Non-native forest communities (e.g., tangantangan, *Vitex*) significantly alter the forest structure, composition, and resilience to other disturbance processes and do not provide the conditions suitable for native flora and fauna species to persist (Morton *et al.* 2000; GDAWR 2006; Guam Department of Agriculture 2010; JRM 2013).

Of the 18,538 acres (7,502 ha) of primary and secondary limestone forest found on Guam, approximately 13,110 acres (5,305 ha) (or 71%) are found primarily within AAFB, Finegayan, and NAVMAG (USFS 2006). Under Alternative 1, approximately 255 acres (103 ha) of limestone forest would be removed, primarily within the Route 15 lands (see Table 5.1.8-2). Therefore, given the importance of primary and secondary limestone forest habitat for native species and the continuing loss of native limestone forest across Guam, the conversion of 255 acres (103 ha) of limestone forest on Andersen South and the Route 15 lands to developed area would be a significant but mitigable impact to the regional vegetation community and its function.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on vegetation communities with implementation of LFTRC Alternative 1. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the contractor education program.
- *Onsite Vegetation Waste Management Procedures*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the vegetation waste management procedures.
- *DON Guam Landscaping Guidelines*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of landscaping guidelines.

- *LFTRC Range Berm Controls*. To manage stormwater runoff and control erosion, LFTRC range berms would contain native or non-invasive herbaceous vegetation and other engineering controls.
- *Contractor Plans and Specifications*. All construction would occur within the limits of construction shown in the project figures.

Potential Mitigation Measures

To mitigate for significant impacts to limestone forest, the DON proposes to implement forest enhancement on a minimum of 255 acres (103 ha) of limestone forest. Forest enhancement would include but is not limited to the following actions:

- Ungulate management consisting of exclusion fencing and active control (i.e. trapping, snaring, shooting) with the goal of eradication within the fenced areas.
- Non-native, invasive vegetation removal.
- Propagation, planting, and establishment of native species that are characteristic of native limestone forest habitats (e.g., *A. mariannensis, G. mariannae, F. prolixa, M. citrifolia, W. elliptica*).

The degradation and loss of primary limestone and other forest habitats resulting from ungulate damage and invasion by alien plant species has substantially diminished the extent of habitat for native species in the Mariana archipelago. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including special-status species. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Terrestrial Conservation Areas. As there are no terrestrial conservation lands designated within the Route 15 lands or Andersen South, there would be no impacts to terrestrial conservation lands with implementation of construction activities associated with LFTRC Alternative 1.

Wildlife - Native Species. There is no new information for wildlife in the Alternative 1 action area, and the impact assessment would be the same as that described in the 2010 Final EIS for a similar LFTRC alternative at Route 15 (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.4.2: Non-DoD Land, pages 10-54 to 10-59). Therefore, there would be less than significant impacts to wildlife species with implementation of Alternative 1.

The following BMPs would be implemented to avoid and minimize potential direct, long-term impacts of proposed construction activities on native wildlife with implementation of Alternative A.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. The DoD has a long history of success in preventing the dispersal of the brown treesnake from Guam in its transport of personnel and cargo (USFWS 2010a). After the publication of the 2009 Guam and CNMI Military Relocation Draft EIS, various agencies within the U.S. Department of Interior expressed concern regarding the

adequacy of brown treesnake interdiction efforts in response to the relocation of Marine Corps forces to Guam. For the purposes of the 2010 Final EIS and this SEIS, interdiction is defined as: "to hinder, prohibit, or prevent the brown treesnake from becoming established in new locations by conducting inspection and suppression processes." The DON agrees that it will fund the increase of current federally funded brown treesnake interdiction measures (in Guam, CNMI, and Hawaii) where the increase is related to direct, indirect and induced growth caused by the Marine Corps relocation to Guam. That funding will continue and become part of the DON's current brown treesnake interdiction funding under authority of the Brown Tree Snake Control and Eradication Act (USFWS 2010a).

JRM has established a comprehensive brown treesnake interdiction program to ensure that military activities, including the transport of civilian and military personnel and equipment to and from Guam, do not contribute to the spread of brown treesnakes to other islands or regions. Brown treesnake interdiction requirements (e.g., trapping and inspections at ports and cargo facilities, aircraft, inspections of household good movements, biosecurity plans for training events) are specified in the DoD instructions (i.e., 36 Wing Instruction 32-7004, *Brown Tree Snake Control Plan* and COMNAVMAR Instruction 5090.10A, *Brown Tree Snake Control and Interdiction Plan*) as well as the annual Work Financial Plan that is developed in cooperation with USDA Wildlife Services. The proposed action would continue to comply with these established procedures.

With implementation of these BMPs, including development of HACCP plans and ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species, the risk of the introduction and establishment of new or spread of existing non-native species on Guam is substantially reduced. Therefore, there would be less than significant impacts to native wildlife species related to the potential introduction and establishment of non-native species with implementation of proposed construction activities associated with Alternative 1.

Damage of forested areas, particularly primary and secondary limestone forests, by non-native ungulates (i.e., deer and pigs) is a serious concern on Guam. Under Alternative 1, removal of large amounts of secondary limestone forest currently used by ungulates would displace and concentrate ungulates into adjacent areas, resulting in even higher densities and potentially greater habitat damage. Potential impacts from changes in ungulate densities from construction projects within the same or similar habitat areas as proposed in this SEIS were addressed in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-115).

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. There are no historical fruit bat roost sites at Andersen South or the Route 15 lands and the last observation of a fruit bat within the Alternative 1 project areas was in 1999. However, there is fruit bat recovery habitat within the impacted areas of the Route 15 lands. Approximately 81 acres (33 ha) of Mariana fruit bat recovery habitat would be removed due to proposed construction activities at Andersen South and the Route 15 lands under Alternative 1 (Table 5.1.8-3). This area is included in the impacts to vegetation discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 5.1.8-3. Summary of Permanent Construction-Related Impacts to Mariana Fruit Bat Recovery Habitat with Implementation of LFTRC Alternative 1

Project Component	*Recovery Habitat (acres [ha])*
Range Areas, Associated Features, and Route 15 Realignment (at Route 15)	80.9 (32.7)
HG Range (at Andersen South)	0
Total Recovery Habitat Impacted	**80.9 (32.7)**

Additional potential direct temporary impacts to the Mariana fruit bat from construction activities are based on the distances from those activities that are likely to cause disturbance to this species (e.g., noise, human activity, lighting). The evaluation of fruit bat disturbance is based on the approach used by USFWS in previous ESA section 7 formal consultations and associated BOs (e.g., USFWS 2006b, 2010). These distances are: roosting habitat within 492 feet (150 m) and foraging habitat within 328 feet (100 m) from the activity (Wiles, personal communication 2006]and Janeke, personal communication 2006, respectively, as cited in USFWS 2006b).

The species is currently limited to the few areas on Guam away from human activities and with suitable habitat, primarily on the NAVMAG and AAFB (JRM *et al.* 2012a, 2012b; JRM 2013; A. Brooke, NAVFAC Marianas, personal communication). However, illegal hunting, loss and degradation of native forest, predation by the brown treesnake, and the increased extirpation risk owing to the high vulnerability of very small populations continue to limit the potential recovery of the species on Guam (USFWS 2010a; JRM 2013). Based on the equilibrium/carrying capacity of snakes on Guam (Rodda and Savidge 2007), implementation of the proposed action is not expected to increase the likelihood of predation by the brown treesnake on Mariana fruit bats.

The loss of 81 acres (33 ha) of fruit bat recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, and it would not substantially reduce the total number of bats that the island can support. Given this small loss of recovery habitat, there would be less than significant impacts to the Mariana fruit bat with implementation of proposed construction activities associated with Alternative 1.

The following BMPs may be implemented to avoid and reduce potential direct long-term impacts of proposed construction activities on Mariana fruit bats and recovery habitat with implementation of Alternative 1.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the contractor education program.
- *Pre-Construction Surveys*. Surveys would be completed within suitable fruit bat habitat 1 week prior to onset of construction activities following the USFWS-approved JRM protocol. If a fruit bat is present within 492 feet (150 m) of the project site, the work must be postponed until the bat has left the area.
- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all new roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

In addition, the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 255 acres [103 ha] of limestone forest) would provide additional benefit to bat recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

MARIANA CROW. The Mariana crow is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the crow is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the crow, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 1, impacts to the crow would be limited to recovery prospects. If the crow is reintroduced and exposed to construction activities under Alternative 1, they may be disturbed (DON 2014).

Although the crow no longer occurs on Guam, approximately 81 acres (33 ha) of crow recovery habitat would be removed due to proposed construction activities at Andersen South and the Route 15 lands under Alternative 1 (Table 5.1.8-4). This area is included in the impacts to vegetation discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 5.1.8-4. Summary of Permanent Construction-Related Impacts to Mariana Crow Recovery Habitat with Implementation of LFTRC Alternative 1

Project Component	*Recovery Habitat (acres [ha])*
Range Areas, Associated Features, and Route 15 Realignment (at Route 15)	80.9 (32.7)
HG Range (at Andersen South)	0
Total Recovery Habitat Impacted	**80.9 (32.7)**

The loss of 81 acres (33 ha) of crow recovery habitat on Guam would not preclude the recovery or survival of the crow, and it would not substantially reduce the total number of crows that the island can support should it be reintroduced to Guam in the future. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to the Mariana crow with implementation of proposed construction activities associated with Alternative 1. If and when the crow is reintroduced to Guam, the best available information indicates project-related noise would not further reduce the amount of recovery habitat suitable for this species' breeding, feeding and sheltering (USFWS 2010a).

The following BMPs may be implemented to avoid and reduce potential direct long-term impacts of proposed construction activities on Mariana crow recovery habitat with implementation of Alternative 1.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

- *Brown Treesnake Interdiction*. See the above discussion of BMPs under Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

In addition, the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 255 acres [103 ha] of limestone forest) and Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW (i.e., brown treesnake research and suppression program) would provide additional benefit to crow recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana crow.

GUAM RAIL. The Guam rail is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the rail is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the rail, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the rail is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 1, impacts to the rail would be limited to recovery prospects. If the rail is reintroduced and exposed to construction activities under Alternative 1, they may be disturbed (DON 2014).

Although the rail no longer occurs on Guam, approximately 283 acres (115 ha) of rail recovery habitat would be removed due to proposed construction activities at Andersen South and the Route 15 lands under Alternative 1 (Table 5.1.8-5). This area is included in the impacts to vegetation discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 5.1.8-5. Summary of Permanent Construction-Related Impacts to Guam Rail Recovery Habitat with Implementation of LFTRC Alternative 1

Project Component	***Recovery Habitat (acres [ha])***
Range Areas, Associated Features, and Route 15 Realignment (at Route 15)	261.9 (106.0)
HG Range (at Andersen South)	21.5 (8.7)
Total Recovery Habitat Impacted	**283.4 (114.7)**

Although the loss of 283 acres (115 ha) of rail recovery habitat on Guam would not preclude the recovery of the rail should it be reintroduced to Guam in the future, it would reduce the total number of rails that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam rail.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the recovery of the Guam rail with implementation of Alternative 1. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 255 acres [103 ha] of limestone forest) would benefit Guam rail recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam rail, should it be reintroduced to Guam in the future.

GUAM MICRONESIAN KINGFISHER. The kingfisher is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the kingfisher is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the kingfisher, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the kingfisher is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative A, impacts to the kingfisher would be limited to recovery prospects. If kingfishers are reintroduced and exposed to construction activities under Alternative 1, they may be disturbed (DON 2014).

Although the kingfisher no longer occurs on Guam, approximately 81 acres (33 ha) of kingfisher recovery habitat would be removed due to proposed construction activities at Andersen South and the Route 15 lands under Alternative 1 (Table 5.1.8-6). This area is included in the impacts to vegetation discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 5.1.8-6. Summary of Permanent Construction-Related Impacts to Guam Micronesian Kingfisher Recovery Habitat with Implementation of LFTRC Alternative 1

Project Component	*Recovery Habitat (acres [ha])*
Range Areas, Associated Features, and Route 15 Realignment (at Route 15)	80.9 (32.7)
HG Range (at Andersen South)	0
Total Recovery Habitat Impacted	**80.9 (32.7)**

The loss of 81 acres (33 ha) of kingfisher recovery habitat on Guam would not preclude the recovery or survival of the kingfisher, and it would not substantially reduce the total number of kingfishers that the island can support should it be reintroduced to Guam in the future. Given this small loss of recovery habitat, there would be less than significant impacts to the kingfisher with implementation of proposed construction activities associated with Alternative 1.

The following BMPs may be implemented to avoid and reduce potential direct long-term impacts of proposed construction activities on kingfisher recovery habitat with implementation of Alternative 1.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

In addition, the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 255 acres [103 ha] of limestone forest) and Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW (i.e., brown treesnake research and suppression program) would provide additional benefit to kingfisher recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

MARIANA EIGHT-SPOT BUTTERFLY. Host plants and adult, immature, and egg stages of the eight-spot butterfly have been observed within the Route 15 lands during surveys in support of the 2010 Final EIS and this SEIS (Campora and Lee 2009; NAVFAC Pacific 2010; UoG 2014).

Some species of tropical butterflies have well-developed ears on their wings and can detect sounds at the same frequencies that humans can hear. It is hypothesized that the butterflies are listening to the flight sounds or foraging calls of predatory birds (Lane *et al.* 2008; Yack 2012). Given the low numbers of forest birds currently on Guam due to the brown treesnake, masking of the flight sounds or foraging calls of predatory birds due to noise from proposed construction activities would not make eight-spot butterflies more susceptible to predation.

With implementation of appropriate BMPs to avoid and minimize potential impacts to eight-spot butterflies (e.g., pre-construction butterfly and host plant surveys within the proposed range areas and salvage/relocation of host plants, larvae or eggs; see Table 2.8-1), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed construction activities under Alternative 1. In addition, implementation of the potential mitigation measures described above under *Vegetation* (i.e., forest enhancement of 255 acres [103 ha] of limestone forest) would also benefit the survival the eight-spot butterfly. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species, including eight-spot butterfly host plants.

SERIANTHES TREE. Although individual *Serianthes* trees do not occur within the impacted areas of Alternative 1, approximately 67 acres (27 ha) of *Serianthes* recovery habitat would be removed due to proposed construction activities at Andersen South and the Route 15 lands under Alternative 1 (Table 5.1.8-7). This area is included in the impacts to vegetation discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Table 5.1.8-7. Summary of Direct Construction-Related Impacts to *Serianthes* Recovery Habitat with Implementation of Cantonment/Family Housing Alternative 1

Project Component	*Recovery Habitat (acres [ha])*
Range Areas, Associated Features, and Route 15 Realignment (at Route 15)	67.0 (27.1)
HG Range (at Andersen South)	0
Total Recovery Habitat Impacted	**67.0 (27.1)**

The loss of 67 acres (27 ha) *Serianthes* recovery habitat on Guam would not preclude the recovery of *Serianthes*, and it would not substantially reduce the total number of *Serianthes* that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to *Serianthes* with implementation of proposed construction activities associated with Alternative 1.

The following BMPs may be implemented to avoid and minimize, potential direct long-term impacts of proposed construction activities on the recovery of *Serianthes* with implementation of Alternative 1.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

The implementation of the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 255 acres [103 ha] of limestone forest) would benefit *Serianthes* habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

HERITIERA LONGIPETIOLATA. An individual tree and a cluster of 22 mature trees and 184 seedlings of *H. longipetiolata* were observed within the proposed MPMG Range footprint during previous surveys of the area (Duenas & Associates 2000) and during surveys for the 2010 Final EIS (NAVFAC Pacific 2010) (see Figure 5.1.8-2). Under Alternative 1, all *H. longipetiolata* would be avoided to the maximum extent practicable during proposed construction activities. With implementation of BMPs, such as salvaging high-value (both biologically and culturally) plant species during construction activities and potential translocation of *Heritiera* trees, particularly seedlings (see Section 2.8), there would be less than significant impacts to *H. longipetiolata* resulting from proposed construction activities under Alternative 1.

Special-Status Species: Guam-Listed and SOGCN

Guam-listed species and SOGCN are also ESA-listed species and are discussed above.

Operation

Vegetation. With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, 1-year post-construction monitoring to evaluate effectiveness of HACCP, and applicable elements of the SIP, the potential for the introduction of new or

spread of existing non-native species on Guam during the operation of Alternative 1 is considered unlikely. Therefore, there would be less than significant impacts to vegetation with operation of the proposed LFTRC under Alternative 1.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by increasing erosion, allowing for the establishment of non-native species, and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. Native plants and their habitats on Guam are adapted to a humid, tropical climate and are not adapted to a fire driven ecosystem (USFWS 2008a). Fire is a serious problem on Guam. Fire history records available from 1979 - 2002 indicate that over this 23-year period more than 16,000 fires have occurred in Guam (averaging more than 700 per year) that have burned in excess of 100,000 acres (40,469 ha), primarily in southern Guam. Of these 16,000 fires, 477 of them occurred on Naval Base Guam, primarily at Apra Harbor and NAVMAG, burning more than 9,800 acres (3,966 ha) (Nelson 2008).

As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's Wildland Fire Management Plan (Nelson 2008) (see Section 2.8). It would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions), and location and management of firebreaks, fire-fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). With implementation of the Range Fire Management Plan, which establishes management and fire suppression and emergency response procedures, potential impacts from range-related wildfires would be less than significant. The USFWS concluded in their BO for the 2010 Final EIS that they anticipated that no additional vegetation would be lost due to wildfires igniting as a result of proposed live-fire training operations (USFWS 2010a). Therefore, there would be less than significant impacts to vegetation from operation of LFTRC Alternative 1.

Terrestrial Conservation Areas. As there are no terrestrial conservation lands designated within the Route 15 lands or Andersen South, there would be no impacts to terrestrial conservation lands with implementation of operational activities associated with LFTRC Alternative 1.

Wildlife - Native Species. Operational impacts to native wildlife would include an increase in noise and lighting. These potential impacts were evaluated in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.2: Central, page 10-129) for a similar proposed action, and were found to be not significant.

With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, 1-year post-construction monitoring to evaluate effectiveness of HACCP, and applicable elements of the SIP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the proposed LFTRC under Alternative 1 is considered unlikely. The DON recognizes the USFWS' ongoing concern regarding potential spread of the brown treesnake. The DON will consult with USFWS under ESA section 7 to determine if additional brown treesnake interdiction measures are warranted and applicable. In addition, lighting associated with the range and support areas would be hooded or shielded to the maximum extent practicable to prevent unnecessary light beyond operational areas. Therefore, there would be less than significant impacts to native wildlife with operation of the proposed LFTRC under Alternative 1.

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. As the Mariana fruit bat does not occur at the proposed HG Range at Andersen South, there would be no impacts to Mariana fruit bats from noise associated with operation of the HG Range.

For those species of fruit bats that have been tested for hearing sensitivity, their audiograms are very similar to those of humans, with similar upper and lower frequency limits and hearing threshold levels (Calford *et al.* 1995; Koay *et al.* 1998; Heffner *et al.* 2006). Therefore, it is likely that noise from live-fire operations at the proposed ranges would be heard by fruit bats as it would be heard by humans.

The USFWS established 60 dB and 93 dB as two thresholds of biological significance based on their review of impacts of noise to wildlife. Noise levels above 60 dB have been found to affect acoustic communication, breeding biology, survival of young, and non-auditory bird and mammal physiology. Noise levels above 93 dB may temporarily or permanently affect hearing (USFWS 2010a). No species would be exposed to noise levels of 93 dB or greater under the proposed action. While noise levels may approach 93 dB in the immediate vicinity of the firing of an individual weapon, fruit bats or other wildlife species would not be in proximity to the live-fire event given the location and nature of weapons firing within a developed range area.

Responses to noise can vary among individuals as a result of habituation where after a period of exposure to a stimulus, an animal stops responding to the stimulus. In general, a species can often habituate to human-generated noise when the noise is not followed by an adverse impact. Even when a species appears to be habituated to a noise, the noise may produce a metabolic or stress response (increased heart rate results in increased energy expenditure) though the response may or may not lead to changes in overall energy balance. Anthropogenic noise disturbance is known to alter animal behavioral patterns and lead to population declines (Barber *et al.* 2011; Francis and Barber 2013; McGregor *et al.* 2013).

In addition to noise level, the frequency and regularity of the noise also affect species sensitivity. That is, different types of noise sources will produce different effects on different species. Noise from aircraft overflights may not produce the same response from a wildlife species as noise from a land-based noise source such as a vehicle, chainsaw, or gun shot. Wildlife species often do not react only to a noise source but more importantly to the visual component associated with that noise source. Nesting birds will react to a noise source by tilting their head, becoming alert, etc. but often do not leave the nest or perch until there is a visual connection with the noise source. For example, birds may not react to just the sound of a chainsaw, but when that sound is coupled with a human walking near the bird, the bird will flush. This is also shown in reactions by various species to aircraft overflights (airplanes and helicopters). An overflight with just a sound component does not elicit a strong response, but if an animal hears and then sees the aircraft, the bird will more likely flush and move away (Bowles 1995; Krausman *et al.* 1993; Manci *et al.* 1988; USFS 1992). In other words, human intrusions near roost sites, nests, foraging areas, etc. (e.g., timber harvesting, hiking, hunting) are readily detectable and substantial (USFS 1992).

Species that are commonly hunted often demonstrate behavioral (e.g., flushing, startle response) or physiological responses (e.g., increased heart rates, increased respiration rates) to gunshot sounds (Larkin *et al.* 1996). Knight *et al.* (1987) found that American crows nesting in urban areas were less wary of people than American crows nesting in rural habitat and attributed the difference to the hunting of rural crows. Barron *et al.* (2012) found that American crows avoided areas with live-fire exercises in a similar fashion and suggested that species hunted by humans will be more adversely affected by human activity, including military training (e.g., live-fire training) than species that are not hunted.

As stated by Morton and Wiles (2002), "Poaching is a particularly insidious activity because not only does it impact fruit bats through mortality, it reinforces behavioral avoidance of humans. Consequently, roosting or foraging fruit bats that might not otherwise be disturbed by some human activities … may become unduly sensitized to them because of illegal hunting." Based on observations on Guam and Rota, fruit bats have abandoned areas where hunting has occurred and did not return even though no further hunting or gunshots occurred within the area for months after (Janeke 2006; AAFB 2008b; USFWS 2009a; Mildenstein and Mills 2013). In addition, anecdotal evidence from numerous individuals who have conducted fruit bat research on Guam and the CNMI for many years indicate that fruit bats do avoid areas that have been previously subjected to hunting and also areas that experience live-fire activities (G. Wiles, Washington Department of Fish and Wildlife, personal communication, 2014; T. Mildenstein, University of Montana, personal communication, 2014; D. Janeke, HDR, Inc., personal communication, 2014; N. Johnson, Marianas Conservation Unlimited, personal communication, 2014). For example, during fruit bat monitoring at AAFB near the CATM range as part of a larger study monitoring the effects of aircraft overflights on fruit bats and crows (JRM *et al.* 2012b), flying fruit bats were observed avoiding the CATM range by 300-400 m when live-fire operations were being conducted (N. Johnson, Marianas Conservation Unlimited, personal communication, 2014).

However, a species can also habituate to human-generated noise when the noise is not followed by an adverse impact. While fruit bats may avoid an area subjected to hunting and the associated gun shots, fruit bats, like most wildlife species, will also learn that if a disturbance or sound does not produce an adverse effect (e.g., mortality), then they can habituate to that disturbance or sound and will not show an adverse reaction (e.g., flying away, avoiding the area) (Boyle and Samson 1985; Francis and Barber 2013).

Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) may influence reproductive success and confound the ability to identify the ultimate factor in limiting productivity of a certain species, area, or region (Smith *et al.* 1988).

Based on identified recovery habitat for the Mariana fruit bat (USFWS 2010b), noise levels of 60 dB ADNL and greater would overlie 669 acres (271 ha) of recovery habitat in the vicinity of Alternative 1 (Table 5.1.8-8 and Figure 5.1.8-3).

Table 5.1.8-8. Noise Levels overlying Mariana Fruit Bat Recovery Habitat (acres [ha]) with Implementation of LFTRC Alternative 1

60-64 dB ADNL	*65-74 dB ADNL*	*75-85+ dB ADNL*	*Total*
85.2 (34.5)	407.1 (164.7)	177.1 (71.7)	**669.4 (270.9)**

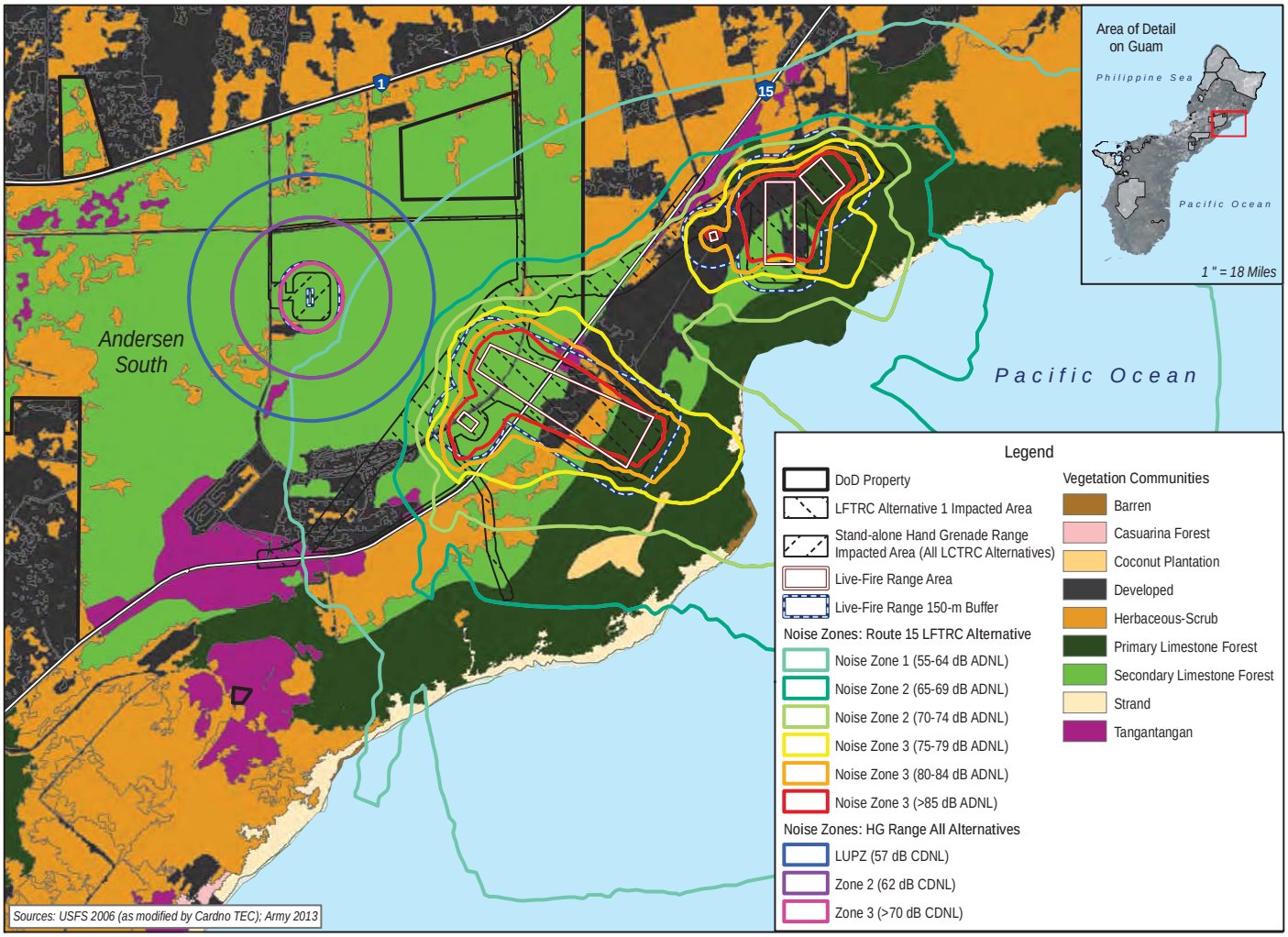


Figure 5.1.8-3
Vegetation Communities within Small Arms ADNL Noise Zones - Route 15 LFTRC Alternative

Given the ongoing poaching of fruit bats on Guam, it is likely that those fruit bats that currently occur on Guam will avoid areas of live-fire training as they may have experienced a poaching event. While there is the potential for eventual habituation by fruit bats to LFTRC live-fire activities, fruit bats are expected to initially avoid areas of live-fire training activities. Therefore, fruit bats may temporarily avoid approximately 669 acres (271 ha) of recovery habitat due to proposed live-fire range operations. However, proposed live-fire operations at the LFTRC are not continuous and would occur between 7:00 a.m. and 7:00 p.m. for 39 weeks per year, and night operations (estimated to occur 2 nights per week over 39 weeks per year) would occur between 7:00 p.m. and 10:00 p.m. or 6:00 a.m. and 7:00 a.m. In addition, live-fire operations would not physically impact recovery habitat. This temporary avoidance of recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, and it would not substantially reduce the total number of fruit bats that the island can support. Therefore, there would be less than significant impacts to the Mariana fruit bat with implementation of proposed operational activities associated with Alternative 1.

MARIANA CROW, GUAM RAIL, AND GUAM MICRONESIAN KINGFISHER. These species are extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of these species is reasonably certain to occur and the species are likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of these species, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow, rail, and kingfisher are successfully re-introduced and then have the potential to be exposed to operational activities under Alternative 1, there would be no impact to these species. If the species are reintroduced and exposed to LFTRC operational activities under Alternative 1, they may be disturbed.

MARIANA EIGHT-SPOT BUTTERFLY. Some species of tropical butterflies have well-developed ears on their wings and can detect sounds at the same frequencies that humans can hear. It is hypothesized that the butterflies are listening to the flight sounds or foraging calls of predatory birds (Lane *et al.* 2008; Yack 2012). Given the low numbers of forest birds currently on Guam due to the brown treesnake, masking of the flight sounds or foraging calls of predatory birds due to noise from proposed construction activities would not make eight-spot butterflies more susceptible to predation.

Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see *Vegetation* above, and Section 2.8), potential impacts from range-related wildfires on Mariana eight-spot butterfly would be less than significant. Therefore, as operation of the range would not remove additional vegetation (e.g., host plants), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed range operations under Alternative 1.

SERIANTHES TREE. *Serianthes* does not occur within the Alternative 1 action area. Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see *Vegetation* above, and Section 2.8), potential impacts from range-related wildfires on *Serianthes* would be less than significant. Therefore, there would be less than significant impacts to *Serianthes* or recovery habitat due to proposed range operations under Alternative 1.

HERITIERA LONGIPETIOLATA. Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see

Vegetation above, and Section 2.8), potential impacts from range-related wildfires on *H. longipetiolata* would be less than significant due to proposed range operations under Alternative 1.

Special-Status Species: Guam-Listed and SOGCN

Guam-listed species and SOGCN are also ESA-listed species and are discussed above.

5.1.9 Marine Biological Resources

5.1.9.1 Affected Environment

The description of the affected environment for marine biological resources associated with the proposed Route 15 LFTRC alternative is found in the 2010 Final EIS and is summarized below for reference (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.6.3: Non-DoD Land, pages 11-51 to 11-54).

Marine Flora and Invertebrates

Site-specific information is limited for this area (Pågat Point). However, marine flora and invertebrate information would be similar to that described for Guam generally in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.4: Guam Regional Environment, pages 11-11 to 11-42).

The shoreline along the proposed Route 15 LFTRC consists of exposed rocky shores and an intertidal beach providing habitat for many intertidal invertebrate species, including octopi, sea cucumbers, swimming crabs, and slipper and spiny lobsters. The nearshore environment generally contains areas of 10-50% coral cover and unconsolidated sediment, with minimal coralline algae, macroalgae (including seagrass), and turf algae (Figure 5.1.9-1). Corals found above the 100-foot (30-m) isobath in this area typically include encrusting, massive, columnar, platy, and branching growth forms of corals conditioned by the dominant trade winds and strong wave action to withstand physically harsh conditions (Navy 2005 [as cited in 2010 Final EIS]).

Fish

The extent to which the coastal waters off Route 15 are used for commercial, recreational or subsistence fishing is not known. However, this area has a much lower overall fish biomass than Guam's marine protected areas (Williams *et al.* 2012).

Essential Fish Habitat

Site-specific information is limited for this study area (Pågat Point). However, general EFH information would be similar to that described in the 2010 Final EIS (Volume 2, Chapter 11: Marine Biological Resources, Section 11.1.4.2: Essential Fish Habitat, pages 11-18 to 11-36), and includes a host of juvenile and adult fish and invertebrate MUS with year-round residence.

Special-Status Species

In the absence of specific habitat or distribution limitations, all four species of coral listed as threatened under the ESA are considered as possibly occurring in any of the alternative study areas for which marine biological resources are analyzed, in this case Route 15 (see Table 3.9.1-2).

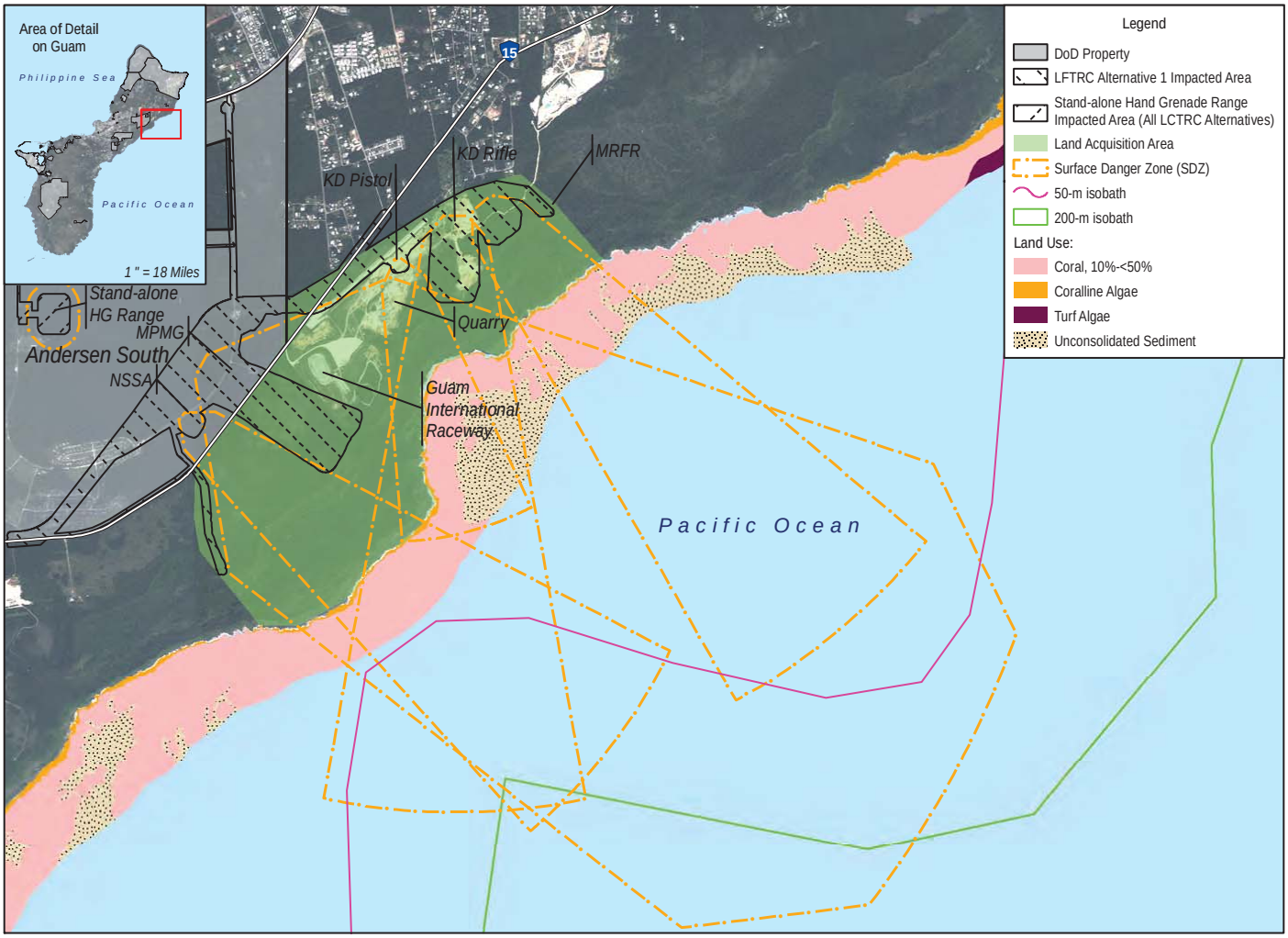


Figure 5.1.9-1
Overview of Sensitive Marine Biological Resources and Nearshore Habitat – Route 15 LFTRC Alternative 1

There are no reported sea turtle nesting beaches or foraging areas in this vicinity (NOAA 2005a [as cited in the 2010 Final EIS]). However, green sea turtles, and to a lesser degree, hawksbill turtles may be present in the coastal waters. The nearest reported nesting beach from Pågat Point is located south of Pago Bay, approximately 5 miles (8 km) south of the Route 15 lands. The nearest potential foraging area is at Taguan Point, approximately 2 miles (3 km) south of the Route 15 lands.

Marine Conservation Areas

There are no marine conservation areas at or adjacent to Alternative 1.

5.1.9.2 Environmental Consequences

Construction

Marine Flora and Invertebrates

There is no in-water construction work proposed for the construction of Alternative 1. Therefore, there are no anticipated direct impacts to marine resources. The measures used to minimize potential impacts from construction activities, including appropriate resource agency specific BMPs, construction and industrial permit BMPs, LID features in accordance with the DoD UFC LID (UFC 3-210-10) and Section 438 of the EISA, USACE permit conditions, and general marine resources protective measures, are described in the 2010 Final EIS (Volume 7 and Volume 2, Chapter 11: Marine Biological Resources, Section 11.2: Environmental Consequences, pages 11-70 to 11-71) and summarized in Chapter 2 of this SEIS. Specifically, the site-specific SWPPP within the Construction General Permit would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flow rate of runoff and thereby minimize suspension of sediment and promote infiltration of runoff.

Contract construction personnel would be issued base passes for official business only and these restrictions would be specified in construction contracts. Increased recreational use of the marine resources near Alternative 1 is therefore expected to be minimal.

The DON plans to educate construction workers via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities around Guam. The above measures would reduce indirect short-term impacts by the construction workforce on marine flora and invertebrates to less than significant.

Fish

The construction of Alternative 1 would result in no direct impacts and less than significant indirect impacts to fish for reasons consistent with those given above for marine flora and invertebrates. There would be no impacts to fish from stormwater, sedimentation, or other non-point source pollution from construction projects due to compliance with the Construction General Permit and the implementation of appropriate construction BMPs.

Essential Fish Habitat

The construction of Alternative 1 would result in no direct impacts and less than significant indirect impacts to EFH for reasons consistent with those given above for marine flora and invertebrates. There would be no impacts to EFH from stormwater, sedimentation, or other non-point source pollution from construction projects due to compliance with the Construction General Permit and the implementation of appropriate construction BMPs.

Per the Magnuson-Stevens Fishery Conservation and Management Act, there would be no adverse effects on EFH because construction of the proposed action would not reduce the quality or quantity of EFH with implementation of access restrictions, environmental education and outreach for the construction workforce, and the Construction General Permit and appropriate construction BMPs.

Special-Status Species

There would be no direct or indirect impacts special-status species as a result of the proposed action with compliance with the Construction General Permit, implementation of appropriate construction BMPs, and access limitations for construction workers, as described for the resources above.

Increased dive boat operations have the potential for increased turtle harassment and strikes. However, because of the mobility of sea turtles combined with implementation of sea turtle specific BMPs, potential increased recreational activities would result in less than significant impacts to sea turtles. In addition, any such impacts to the sea turtle population would be reduced in intensity from the previously proposed action evaluated in the 2010 Final EIS and the proposed action assessed in this SEIS would continue to be in compliance with the 2010 NMFS BO.

Marine Conservation Areas

There are no marine conservation areas in the vicinity Alternative 1. Therefore, there would be no impacts to such areas.

Operation

Potential impacts to marine biological resources as a result of operation of the proposed live-fire training ranges and associated range operation and control facilities at Route 15 are assessed below, but are generally described in the 2010 Final EIS for the Route 15 alternatives (Volume 2, Chapter 11: Marine Biological Resources, Section 11.2.2.2: Central, pages 11-85 to 11-92).

For analytical purposes, a very small number of rounds fired at all proposed ranges would fall outside the range footprint, but within the SDZ. This is based on ricochets, not direct fire, meaning the speed of the bullet, and therefore the distance traveled, would be reduced after the bullet deflected off a surface. The 2010 Final EIS described an analysis conducted using a combination of Marine Corps and Army methodology to determine the probability of direct strikes to a marine mammal, which found a very low likelihood that a projectile would come in contact with a dolphin (0.08524 dolphins per year), with an even lower possibility of imparting significant injury to the animal. Should munitions land in the water, the rapid sinking rate of such munitions is expected to preclude ingestion by marine organisms.

Scoping comments for this SEIS noted concern regarding the possibility that contamination could migrate from the ranges through stormwater runoff. However, as discussed in Section 5.2.2, Water Resources, there would be no impacts to nearshore waters through implementation of surface water protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs during construction and implementation of LID features in accordance with the DoD UFC LID (UFC 3-210-10) and Section 438 of the EISA, range maintenance BMPs, and pollution prevention plans during operations). Specifically, the site-specific SWPPP within the Construction General Permit would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flow rate of runoff and thereby minimize suspension of sediment and promote infiltration of runoff. In addition, LID measures would include vegetated swales for conveyance and detention/retention ponds capable of capturing, storing, and treating additional runoff from the 25-year design storm. For each basin, water quality treatment strategies were selected based on the effectiveness of BMPs to treat

identified pollutants of concern from proposed land uses within that basin. Implementation of LID would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event.

In addition, erosion control, sediment runoff control, spent munitions containment strategies would be implemented, and munitions and residue from range construction or use would remain on ranges to be treated and managed according to applicable DoD Directives, UFC, and the manual titled, "Prevention of Lead Migration and Erosion from Small Arms Ranges" (NAVFAC Pacific EV24SH, personal communication, April 26, 2013). As discussed in Section 5.1.2, Water Resources, there would be no impacts to nearshore waters through implementation of surface water protection measures (i.e., implementation of LID, range maintenance BMPs, pollution prevention plans during operations).

Marine Flora and Invertebrates

There would be no in-water training. Given the nominal quantity of bullets that would overshoot the bermed areas to enter the marine environment and the BMPs described above, no direct long-term impacts are expected to occur to marine flora and invertebrates as a result of the operation of the proposed LFTRC at Route 15.

Fish

As previously discussed under Marine Flora and Invertebrates, the nominal quantity of bullets that would overshoot the bermed areas to enter the marine environment and implementation of the BMPs described above would result in less than significant direct impacts to fish from LFTRC operational activities.

Essential Fish Habitat

As previously discussed under Marine Flora and Invertebrates, the nominal quantity of bullets that would overshoot the bermed areas to enter the marine environment and implementation of the BMPs described above would result in less than significant direct impacts to EFH from LFTRC operational activities. Per the Magnuson-Stevens Fishery Conservation and Management Act, there would be no adverse effect on EFH because construction of the proposed action would not reduce the quality or quantity of EFH with implementation of access restrictions and the Construction General Permit and appropriate construction BMPs.

Special-Status Species

No explosive projectiles are proposed for use and all projectiles are expected to be contained within the range footprint by bullet traps or backstops, with the exception of ricochets, which would be contained within the SDZs, according to statistical analysis provided in the 2010 Final EIS. Signage as well as lighting (blinking red lights) would notify people in the area that the ranges are in use. However, the signage and lighting would be designed to insure minimal to negligible impacts on special-status species, primarily sea turtles. Therefore, there would be less than significant direct impacts to special-status species as a result of LFTRC operational activities.

Marine Conservation Areas

There are no marine conservation areas in the vicinity of Alternative 1. Therefore, there would be no impacts to such areas.

5.1.10 Cultural Resources

5.1.10.1 Affected Environment

The following discussion summarizes previous cultural resources studies, known historic properties, and other cultural resources within the PDIA and PIIA associated with Alternative 1. The Alternative 1 area, also known as the Route 15 alternative, is situated on the northeast side of the island of Guam. It includes a portion of Andersen South, but the majority of the lands are located just south of Andersen South, separated by Route 15. Current land ownership outside of Andersen South includes the GovGuam, Guam Ancestral Land Commission, Chamorro Land Trust Commission, and private landowners. Historically, some of the area appears to have been part of the U.S. Marine Transient Center in 1946 and was subject to mechanical clearing by 1953.

The affected environment for cultural resources associated with Alternative 1 is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 12: Cultural Resources, Section 12.1.3.1: Andersen South and Section 12.1.3.3: Non-DoD Land, pages 12-20 to 24). This description of the affected environment is updated here with new information from recent archaeological and architectural investigations conducted for this SEIS and other projects. To determine whether site information is from previous investigations (such as the 2010 Final EIS or other cultural resource studies) or prepared during in-fill studies conducted for this SEIS, refer to dates in the reference column in each table for the archaeological sites. Certain information about built properties (such as date and function) was derived from iNFADS.

The majority of the Alternative 1 PDIA and PIIA was surveyed for the presence of cultural resources for the original proposed action (2010 Final EIS). Cultural resource investigations for the Final EIS and other previous investigations included archaeological surveys (Moore 1987; Moore *et al.* 2002; Moore *et al.* 2007; Welch 2010; Dixon *et al.* 2011a), architectural inventories (Yoklavich *et al.* 1996, Mason Architects 2004; Welch 2010), and TCP studies (Griffin *et al.* 2010). Additional investigations conducted for this SEIS included intensive cultural resource inventories in the PDIA and reconnaissance inventories in the PIIA (Dixon *et al.* 2015a, 2015b). Note that portions of the PIIA (60 acres [24.3 ha]) were not inventoried, because of steep topography or a lack of accessibility; however, a previous survey in the area did record one site in the area most likely to contain cultural resources. This information has been incorporated in this analysis. Collectively, these investigations provide the inventory of cultural resources for analysis in Alternative 1.

As described in 5.1.10.1, the HG Range would be located at Andersen South under all of the LFTRC alternatives. This entire area was previously surveyed at an intensive level (Welch 2010; Dixon *et al.* 2011a).

During October to December 2014, the DON consulted with the parties to the 2011 PA and the public on the Draft TRRA. Consistent with Stipulation V.C of the 2011 PA, the TRRA provided planning level information on potential direct and indirect effects to historic properties within areas that may be selected in the DON's ROD for the live-fire training range complex. The Draft TRRA included information on the locations, orientations, and designs of each proposed LFTRC location. In addition to receipt of written comments, DON cultural resources professionals conducted three consultation sessions with the parties to the PA to discuss the analysis. The DON will take all comments into account in preparing the Final TRRA, which is planned for publication shortly after this Final SEIS. Comments and considerations developed during the Draft TRRA consultation process have been incorporated in this Final SEIS and informed the Draft RMP, as required by Stipulation V.C.4 of the 2011 PA.

Cultural Resources in the Alternative 1 PDIA

Alternative 1 would involve the construction of individual ranges, support buildings, parking areas, towers, access roads, and the relocation of a portion of Route 15. This construction area comprises the PDIA.

Table 5.1.10-1 lists 10 known archaeological sites located within the Alternative 1 PDIA on Andersen South and the area south of Route 15. Three sites, Pre-Contact/Latte Period ceramic scatters, are eligible for listing in the NRHP. Seven sites are considered ineligible for listing in the NRHP.

Table 5.1.10-1. Archaeological Sites within the Alternative 1 PDIA

GHPI Number[1]	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-04-2104	PBI 1, 4	Ceramic scatter[2]	Pre-Contact/Latte	Moore 1987	Yes	D
66-04-2324	AS-T-2007-07	Ceramic scatter	Pre-Contact/Latte	Welch 2010	Yes	D
	AS-T-2008-01	Ceramic scatter	Pre-Contact/Latte	Dixon *et al.* 2011a	Yes	D
66-04-1869	GRP 1	Ceramic scatter	Pre-Contact/Latte	Moore 1987	No	NA
	GRP 2	Artifact scatter	Pre-Contact/Latte	Moore *et al.* 2002	No	NA
	GRP 3	Artifact scatter	Pre-Contact/Latte	Moore *et al.* 2002	No	NA
	GRP 4	Artifact scatter[2]	Pre-Contact/Latte	Moore *et al.* 2002	No	NA
	GRP 5	Artifact scatter	Pre-Contact/Latte	Moore *et al.* 2002	No	NA
	PBI 3	Pottery scatter	Pre-Contact/Latte	Moore *et al.* 2007	No	NA
	AS-2007-T-1/1066*	Marianas-Bonins base command area remnants - concrete pads, roads, other remains	Post-WWII/ Second American Territorial	Welch 2010	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable. NRHP criterion D = eligible for potential to yield information important in prehistory or history.

Note: [1] Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys and submitted to SHPO.

[2] Sites are in both the PDIA and the PIIA.

*Map number from Welch 2010.

**Revised to match Guam GHPI forms dated May 28, 2014.

One archaeological site and one architectural property considered not eligible for listing in the NRHP have been identified within the PDIA of the proposed HG Range (Tables 5.1.10-2 and 5.1.10-3).

Table 5.1.10-2. Archaeological Sites within Stand Alone Hand Grenade Range Potential PDIA (Common to All LFTRC Alternatives)

GHPI Number	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
	AS-2007-T-1/ 10668	Marianas-Bonins (MARBO) base command area remnants - concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable.
Note: [1]Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys and submitted to SHPO.
*Map number from Welch 2010.
** Revised to match Guam GHPI forms dated May 28, 2014.

Table 5.1.10-3. Summary of Architectural Properties within the Stand Alone Hand Grenade Range PDIA (Common to All LFTRC Alternatives)

Building/Structure Type	*Location*	*Number of Buildings/ Structures of this Type in Potential Impact Area*	*Date of Construction*	*NRHP Eligible?*
Sewer Lift Station (Facility 1120)	Andersen South	1	1949	No

Portions of the Alternative 1 PDIA, including the HG Range, are located in Andersen South, where architectural properties are present. Approximately half of the buildings at Andersen South have been assessed for potential NRHP eligibility (Mason 2004; SEARCH 2013; Welch 2010; Yoklavich *et al.* 1996). Most of the buildings at Andersen South are abandoned housing units that were built in either 1948 or 1978. Other buildings include support facilities built in the 1940s, 1960s and 1980s.

There are 53 architectural properties, constructed between 1945 and 1990, in the PDIA (Table 5.1.10-4). Forty-two of these buildings and structures are part of the Andersen South Housing Development built in 1948 and 1978; all of these buildings are considered not eligible for listing on the NRHP. Other architectural resources include two gatehouses built in 1990 and nine water support facilities that are all considered not eligible for listing in the NRHP.

Table 5.1.10-4. Summary of Architectural Properties Located within the Alternative 1 PDIA

Building/Structure Type	*Location*	*Number of Buildings/ Structures of this Type in Impact Area*	*Date of Construction*	*NRHP Eligible?*
Abandoned Housing (Wilson Homes)	Andersen South	21	1948	No
Abandoned Housing	Andersen South	21	1978	No
Security Gatehouses	Andersen South	2	1990	No
Water Facilities	Andersen South	9	1945 to 1987	No

Notes: Information on type, number, and date of construction from iNFADS.

No TCPs have been identified in the PDIA for this alternative.

Cultural Resources in the Alternative 1 PIIA

The PIIA comprises the area within the SDZs for the LFTRC and HG range and associated areas potentially affected by increases in noise. Table 5.1.10-5 summarizes the eight known archaeological sites located within the Alternative 1 PIIA. Of these 8 sites, 6 are eligible for listing in the NRHP and include 2 ceramic scatters, 2 caves/rock alignments, and Pågat and Pågat Point, a latte complex and an agricultural complex and potential TCP (Griffin *et al.* 2010). Of the remaining 2 sites, 1 artifact scatter is ineligible for listing in the NRHP and 1 cobble alignment has not been evaluated.

Table 5.1.10-5. Summary of Archaeological Sites Known to be Located within the Alternative 1 PIIA

Site Type	*Period*	*Number of Sites of this Type in the Impact Area*	*NRHP Eligible?*	*NRHP Criteria*
Pågat Site and Pågat Point Agricultural Complex/Potential TCP	Pre-Contact/Latte	2	Yes	A, D
Ceramic scatter	Pre-Contact/Latte	2	Yes	D
Rock Alignments/Caves	Pre-Contact/Latte	2	Yes	D
Cobble Alignment	Pre-Contact/Latte	1	Not Evaluated	NA
Artifact scatter	Pre-Contact/Latte	1	No	NA

Legend: NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.

There is one structure located in the PIIA for Alternative 1. It is a water storage tank that was built in 1961. It has not been evaluated for listing in the NRHP. Should this alternative be selected, the structure would be addressed consistent with the procedures outlined in the 2011 PA. One potential TCP, the Pågat Point site, has been identified in the PIIA for this alternative and there is one potential TCP in the vicinity—the Pågat site (site 66-04-0022), which is located adjacent to, but outside of, the area to the westernmost extent of the PIIA.

5.1.10.2 Environmental Consequences

Construction

Construction of Alternative 1 has the potential to adversely affect historic properties and impact culturally important natural resources. Final determinations would follow the procedures in the 2011 PA. Following is a discussion of potential direct and indirect effects to historic properties and impacts to culturally important natural resources.

Construction of the ranges, support facilities, utilities, and relocation of Route 15 would primarily occur in the southeastern portion of Andersen South and the northeastern and central portion of the area south of Route 15 (see Figure 2.5-2). Given the substantial development anticipated in the PDIA, it is assumed for purposes of this analysis that 100% of the PDIA would be disturbed. Nevertheless, design alternatives to avoid and minimize adverse effects would be considered, consistent with procedures in the 2011 PA. No construction is proposed in the PIIA.

Excavation and soil removal associated with the construction of Alternative 1 could adversely affect three historic properties, including Pre-Contact/Latte Period artifact scatters (see Table 5.1.10-1). One of the historic properties is located in both the PDIA and PIIA. Direct impacts to the site would only occur to the portion within the PDIA. Construction associated with Alternative 1 would also require the demolition of 50 buildings and structures (Table 5.1.10-6). None of the buildings and structures are eligible for listing in the NRHP.

Table 5.1.10-6. Architectural Properties to be Demolished within the Alternative 1 Potential Direct Impacted Area

Building Name or Type	*Location*	*Building Number(s)*	*Date of Construction*	*NRHP Eligible?*
Abandoned Housing	Andersen South	222, 223, 224, 225, 226, 227, 228, 229, 230, 232, 234, 236, 238, 242, 244, 246, 248, 250, 290, 292, 1052*	1948	No
Abandoned Housing	Andersen South	300, 301, 302, 303,304, 305, 320, 322, 323, 324, 325, 326, 327, 328, 330, 331, 332, 333, 338, 340	1978	No
Security gatehouses	Andersen South	245,247	1990	No
Valve House	Andersen South	680	1945	No
Water Pump House	Andersen South	681, 682	1945	No
Emergency Generator	Andersen South	683	1981	No
Water Supply	Andersen South	685	1968	No
Water Storage	Andersen South	690	1961	No
Water Pump House	Andersen South	8153	1987	No

Note: *Map number from Welch 2010 (not a facility number).

Construction activities associated with Alternative 1 would not affect the Pågat Site (site 66-04-0022), which includes Pågat Village and Pågat Cave. Under this alternative, the range complex would be located on the limestone plateau, west and more than 300 feet (91 m) in altitude above the Pågat site, and would not be visible from the site. Consistent with the 2011 PA, access to the Pågat Site would not be affected by construction.

Construction activities associated with Alternative 1 have the potential to directly impact culturally important natural resources. The 2011 PA contains measures for coordinating with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners and traditional artisans regarding identification and disposition of these important resources prior to construction (see 2010 Final EIS, Volume 2: page 2-10; Volume 9, Appendix G, Chapter 4).

No historic properties or culturally important natural resources are anticipated in conjunction with utility upgrades that would be associated with Alternative 1. The modification or replacement of existing overhead electrical lines under Alternative 1 would not affect any known cultural resources. There are no known NRHP-eligible properties or culturally important natural resources located in areas planned for water or wastewater upgrades to support Alternative 1.

There are no historic properties located in the PDIA or PIIA for the proposed HG Range at Andersen South. Therefore, no adverse effects to historic properties are anticipated due to construction of the HG Range.

Operation

Operations associated with Alternative 1 could cause indirect adverse effects to historic properties as discussed below. Final determinations of effect would follow the procedures in the 2011 PA. Following is a discussion of potential adverse effects of operations associated with Alternative 1.

The potential for direct effects within the SDZ would be limited to the risk of strikes from stray rounds during Alternative 1 operations. The risk of such effects occurring is extremely low. The range would be designed to contain live fire inside the range itself to minimize the probability of rounds landing in the SDZ. The natural terrain would also serve to prevent direct effects in the SDZ, because the culturally sensitive areas within the Alternative 1 SDZs are substantially lower in elevation than the site of the range. Additionally, if a stray round were to escape the range, the chance of it hitting a historic property is remote, given the size of the SDZ and dispersal of historic properties. For these reasons, the potential for direct adverse effects as a result of range operations is *de minimis*.

Indirect adverse effects to NRHP-eligible archaeological sites from the operation of Alternative 1 could result from changes affecting site integrity. For many types of archaeological sites (e.g., ceramic scatters, rock alignments), auditory impacts associated with live-fire operations would not affect characteristics that qualify them for the NRHP. An increase in noise associated with live-fire operations may adversely affect historic properties for which solitude, quiet, or contemplation contribute to or define their significance, such as TCPs. Under Alternative 1, small arms live-fire noise would be audible near four NRHP-eligible sites that are located within the expanded noise contours. Average noise levels during range operations are projected to increase from current levels to between 65 dB and 85 dB ADNL (see Section 5.1.4, Noise). Three of the sites are a Pre-Contact artifact scatter and a rock alignment, while the remaining site is Pågat Point, a potential TCP. At the Pågat Point site, anticipated noise levels could be over 70 dB ADNL. Auditory impacts associated with range operations would not adversely affect the integrity of the NRHP-eligible artifact scatters and rock alignment. Changes to the setting of the Pågat Point site could be adverse, if the property is confirmed as a TCP. Final determinations of effect would follow the procedures in the 2011 PA. Potential mitigation to reduce noise impacts as discussed in Section 5.1.4, Noise, include the development of a detailed noise reduction plan, which may include maintaining/enhancing dense foliage and/or constructing berms to mitigate noise.

An indirect adverse effect to the Pågat Site (GHPI Number 66-04-0022) from visual intrusions associated with Alternative 1 could result from construction of an observation tower near the cliffline on the plateau above this site. Final design characteristics of the tower, including height and location, would be dependent upon topography and other environmental conditions. Based on the current preliminary concept plan, the tower would be visible from the Pågat Site. The effect to the setting of the Pågat Point site could be adverse. If this alternative is selected, a final determination of effect would follow the procedures in the 2011 PA, including analysis in the TRRA and development of measures to avoid, minimize, and mitigate adverse effects in the RMP. Consultation and additional design reviews would be conducted to evaluate alternatives to reduce visual impacts to the extent practicable.

Operation of this alternative would not result in restricted access to the Pågat Site (GHPI Number 66-04-0022), which includes Pågat Village and Pågat Cave. Range complex operations under this alternative could lead to increased population in the area, which could increase the risk of inadvertent damage. The 2011 PA includes a provision to provide Cultural Resources Awareness Training to all DoD personnel and contractors in order to lessen the risk. The implementation of BMPs, and the institution of a groundwater monitoring program at the range as described in Section 5.1.2.2, would ensure that the groundwater and freshwater pools at the Pågat site would not be contaminated.

Summary of Impacts and Potential Mitigation Measures

Implementation of Alternative 1 could cause direct, adverse effects to three known NRHP-eligible sites. Potential indirect adverse effects could occur to one NRHP-eligible site/potential TCP within the PIIA from an increase in noise. Indirect adverse effects could occur to one additional archaeological

site/potential TCP (the Pågat site, GHPI Number 66-04-0022) due to an increase in recreational pedestrian traffic and visual intrusion from an observation tower. In addition, culturally important natural resources could be directly impacted due to removal of limestone forest. The 2011 PA includes measures to coordinate with SHPO and concurring parties to address appropriate treatment of these resources.

Under this alternative, adverse effects from construction would be fewer than any of the other LFTRC alternatives. Adverse effects from operation could occur, but would be fewer than any of the other alternatives. Refer to Section 5.7, Table 5.7-1 for a comparison of cultural resources impacts and potential mitigation measures for each LFTRC alternative.

The 2011 PA, as discussed in Section 3.1.2., establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. Broadly, the 2011 PA includes processes to share information, consider views of the public, and develop mitigation measures when historic properties may be adversely affected. The 2011 PA provides measures for mitigating adverse effects to NRHP-eligible or listed archaeological sites, consulting on new projects and initiating additional identification efforts, and resolving impacts due to loss of access to TCPs or culturally important natural resources.

More specifically, the 2011 PA established a process for the review and analysis of potential effects to historic properties and other cultural resources for all alternative LFTRC locations. Beginning in October 2014, the DON consulted with the parties to the PA and the public on the TRRA, which provided information about cultural resources potentially affected by the LFTRC alternatives carried forward in the SEIS, consistent with PA Stipulation V.C.4. The TRRA provides information on potential adverse effects resulting from the construction and operation of the LFTRC alternatives to support consultation with the PA parties and the public. The DON will take all comments into account before reaching a final decision. For any alternative selected in the ROD, the 2011 PA stipulates that an RMP will be prepared to address effects from the construction and operation of the ranges. The RMP, developed in consultation with the consulting parties, will stipulate measures to avoid, minimize, and mitigate adverse effects to historic properties.

To the degree possible, direct and indirect impacts to historic properties and natural resources of cultural importance would be avoided or minimized during the planning process. Consultation under the 2011 PA would address potential adverse effects and alternatives to avoid adverse effects. Refer to Section 3.10 for more information on definitions and procedures. If avoidance is not possible, Table 5.1.10-7 presents potential mitigation measures to resolve adverse effects to historic properties and reduce impacts to cultural resources resulting from the implementation of Alternative 1. With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that significant impacts, as defined under NEPA, could be reduced to a level below significance.

Table 5.1.10-7. Potential Mitigation Measures for Alternative 1 for Adverse Effects (NHPA) and Impacts to Other Cultural Resources (NEPA)

NHPA Effects	***Mitigation***
Potential direct adverse effects to three historic properties--NRHP-eligible archaeological sites from construction and potential indirect adverse effects to one NRHP-eligible site/potential TCP from changes in use that degrade site integrity and one from visual intrusions to the setting.	Development and implementation of the RMP to identify specific measures to avoid, minimize, and mitigate direct and indirect adverse effects to historic properties.
Potential indirect adverse effects to one NRHP-eligible archaeological site/potential TCP from recreation use and population increase.	Conduct orientation briefs for DoD personnel to enhance Cultural Resources Awareness and reduce the risk of inadvertent damage.
NEPA Impacts	***Mitigation***
Potential impacts to culturally important natural resources.	Through the PA process, coordinate with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans to provide an opportunity to collect these resources consistent with installation security instructions and safety guidelines prior to construction.

5.1.11 Visual Resources

5.1.11.1 Affected Environment

A list and description of visual resources along Route 15 are provided in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.1.2.11: Andersen South and Section 13.1.2.2 Non-DoD Land, pages 13-24 to 13-31). Typical views from the Route 15 project area are provided on page 13-26 of the above-referenced section in the 2010 Final EIS. The general visual quality of the area is moderately high, with a moderate vividness, moderately high intactness, and moderately high unity. This visual quality is summarized in Tables 13.1-5 and 13.1-6 of the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.1.2.5: Off-Base Roadways, pages 13-36 to 13-38). The high ratings reflect the forested areas on either side of the roadway.

Alternative 1 includes realigning a portion of Route 15 through Andersen South, as described in the 2010 Final EIS. Approximately two-thirds of this new alignment would cut through the forested area. The remaining one-third would run through an area that once served as military housing, which has since been removed. Old roads and cleared areas remain in this area. Typical views for the project area are shown in Photos 5.1.11-1 and 5.1.11-2.



Photo 5.1.11-1. View of the existing Route 15 northbound

Source: AECOM 2010a



Photo 5.1.11-2. View of the existing Route 15 southbound

Source: AECOM 2010b

5.1.11.2 Environmental Consequences

Construction

During construction, activities and equipment would temporarily cause view obstructions where recognized views currently exist. The direct visual impacts during the construction phase would be short-term and less than significant.

Operation

The impacts on visual resources under Alternative 1 would be the same as those discussed in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.2.2: Environmental Consequences, pages 13-262 to 13-68). Clearing and grading for rerouting Route 15 and development of the live-fire training range would result in moderate to substantial alteration of the existing landscape. As part of the new road, two highway underpasses would be constructed on the portions of the road extending through Andersen South. Public views would change from a primarily vegetated landscape to cleared views exposing berms

and existing structures (including roadways, parking areas, fencing, and entry gates). Alternative 1 would require the creation of a relatively large, cleared roadbed and shoulder area inland from the existing road, resulting in a less natural topography and less mature vegetated appearance than currently exists at this location.

As discussed in the 2010 Final EIS, the realignment of Route 15 inland, the need for grading, filling and land clearing, and the need to excavate for the construction of two underpasses would result in the significant alteration of the visual landscape. However, with the exception of a small portion of the new road that would be built on private property at the north end, the majority of the new roadway would traverse DoD property at Andersen South - lands currently not accessible to the general public.

While the visual landscape would be substantially altered during the construction phase, Alternative 1 would not result in significant negative visual impacts. Over time, the graded and replanted areas would blend with the surrounding topography, and eventually, the surrounding vegetative cover as well. The realigned Route 15 would traverse the same type of fast-growing scrub forest areas as those bordering the existing road, and would produce the same type of visual experience as those from the current route. Alternative 1 would have more of an impact to visual resources than Alternatives 2 or 5, but less of an impact than Alternatives 3 and 4, because the long-term visual environment may not result in negative impacts after construction and replanting are complete.

5.1.12 Ground Transportation

5.1.12.1 Affected Environment

The affected environment for ground transportation resources associated with Alternative 1 includes transportation facilities internal to the site (range roadways and intersections). This section discusses existing conditions and assesses how the operations and construction of Alternative 1 would potentially affect transportation conditions for roadways and intersections within the LFTRC site. Impacts to off-base (external) roadways and intersections are summarized in Section 6.1 of this SEIS.

5.1.12.2 Environmental Consequences

Potential ground transportation impacts addressed in this section are limited to elements of the proposed action that could affect roadways internal to the LFTRC site. Potential ground transportation impacts to off-base (external) roadways are addressed in Section 6.1 of this SEIS.

Construction

Potential construction impacts for Alternative 1 would be the same as those described in Section 4.1.12.2 for Alternative A. Potential direct and indirect impacts to ground transportation resources from construction would be minimized with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, there would be less than significant short-term impacts to on-base (internal) roadways.

Operation

Proposed access to Alternative 1 would be from Route 1 through the existing Andersen South access road. An underpass under the relocated Route 15 would allow access to the internal range road network. Alternate access would be via a second underpass under the Route 15 bypass. The proposed access roadway network would avoid an increase in traffic on Route 15 and local roads. Additionally, the location of Route 15 adjacent to the existing Andersen South Training Complex would facilitate transition

from live-fire to non-live fire training and provide maximum efficiency for range maintenance and management.

Active-duty Marine Corps personnel based on Guam would participate in various training courses at the existing Andersen South Training Complex facility and at the proposed LFTRC. Normal range operations require that trainees arrive before 7:00 a.m. and stay until late afternoon. Based on this schedule, trips to the LFTRC would occur prior to the weekday morning peak hour (7:00 a.m. to 8:00 a.m.) and return trips were conservatively modeled as occurring during the weekday afternoon peak hour (4:30 p.m. to 5:30 p.m.).

Transportation of UDP personnel to and from the LFTRC would be provided using passenger buses, as UDP personnel would generally not be expected to have access to POVs. However, permanent party officers and SNCOs would have the option to utilize POVs. Lower-ranked personnel would be required to use GOVs to and from the LFTRC. Support staff assigned to the ranges may commute via POV or GOV. It is assumed that a proportion of permanent party officers and SNCO's would elect to drive a POV. In addition to transporting personnel, transportation requirements include the movement of equipment and ammunition to the LFTRC via MTVRs. Each range would also be required to have an emergency response vehicle. A summary of daily transportation requirements for the LFTRC by vehicle type is provided in Table 5.1.12-1, and represents the maximum potential adverse effect for traffic.

Table 5.1.12-1. Daily Marine Corps Training Trips

Training Course	*Vehicle Type*			
	Auto	*Bus and MTVR*	*Delivery Truck*	*Emergency Vehicle*
LFTRC	32	6	8	1
Andersen South	6	29	4	2

Legend: MTVR = Medium Tactical Vehicle Replacement.
Sources: FHWA 2013a, 2013b.

Approximately 32 privately-owned vehicles, 6 buses and MTVRs, 8 delivery trucks, and 1 emergency vehicle would be added to the roadway network per weekday in support of training activities at the proposed LFTRC. Each vehicle would make two trips: one trip to the training facility during off-peak hours and one return trip during the weekday p.m. peak hour. A summary of the weekday afternoon peak hour LFTRC-related traffic is provided in Table 5.1.12-2.

Table 5.1.12-2. Marine Corps LFTRC Training Trips - Weekday p.m. Peak Hour

LFTRC	*Vehicle Type*				*Total*
	Auto	*Bus and MTVR*	*Delivery Truck*	*Emergency Vehicle*	
Vehicles	16	3	4	1	24
Passenger Car Equivalents	16	9	12	1	38

Legend: MTVR = Medium Tactical Vehicle Replacement.
Notes: Buses, MTVRs and delivery trucks are assigned a primary constituent element of 3.0 to account for their size and acceleration relative to passenger cars.
Sources: FHWA 2013a, 2013b.

As shown in Table 5.1.12-2, training requirements at the LFTRC would result in the addition of approximately 38 trips (passenger car equivalents) to the roadway network during the weekday afternoon peak hour.

Under any of the proposed LFTRC alternatives, construction of new internal roadway facilities and entry control facilities would be required. The proposed action includes construction of internal roadways and

entry control facilities that would be implemented by the DoD. The internal range roadways and intersections have been designed to accommodate the expected travel demand on the facilities. Specifically, internal range roadway segments and intersections would operate at acceptable LOS (LOS A, B, C, D, or E) under future year (Year 2030) conditions with the proposed action.

The proposed action would not result in a direct, long-term significant impact to internal (range) roadway segments or intersections because the proposed action would not:

- For roadway segments and intersections - cause a roadway segment or intersection operating at acceptable LOS (LOS A, B, C, D, or E) to degrade to unacceptable LOS F.
- For roadway segments - add 5% or more to the total directional peak hour volume (measured in passenger car equivalents) and result in unacceptable LOS F.

For intersections - add 50 or more peak hour trips (measured in passenger car equivalents) and result in unacceptable LOS F.

5.1.13 Marine Transportation

5.1.13.1 Affected Environment

The Route 15 LFTRC alternative location and orientation would result in an SDZ that encompasses an area of approximately 2,805 acres (1,135 ha) of the Pacific Ocean off the southeast coast of Guam. The Alternative 1 SDZ would not cross into a designated shipping lane.

5.1.13.2 Environmental Consequences

Construction for the project takes place on shore with no in-water or coastal components; therefore, there would be no impacts to marine transportation during construction. The area of the SDZ would be closed to all vehicle traffic on an intermittent basis, in accordance with 33 CFR 334, to allow uninterrupted training. The short-term nature of the closure and the location of the SDZ away from marine shipping lanes would result in a less than significant impact on marine transportation during operation of the LFTRC.

In order to ensure that watercraft are not at risk of accidentally entering the SDZ and being struck by projectiles fired from the firing ranges, designated military personnel, trained in the use of sighting equipment, would observe the SDZ and nearby waters for vessel traffic. Two proposed Range Observation Towers would give observers an unobstructed view to survey the SDZ for vessels before and during live-fire exercises. Live-fire training would cease if a vessel entered the SDZ and resume only when the SDZ was cleared. Cessation of live-fire via observer notice would minimize the risk of a vessel being struck by projectiles. The SDZ area would be identified on nautical charts, but would not be physically marked on the ocean surface. Standard operating procedures would be implemented to notify mariners of training activities and ensure that the SDZ is cleared of vessels prior to live-fire training. The direct and indirect short- and long-term impacts would be less than significant.

5.1.14 Utilities

5.1.14.1 Affected Environment

<u>Electrical Power</u>

The electrical utility near Alternative 1 consists of an existing local GPA power distribution system. The existing system is a 13.8 kV overhead distribution line. These distribution lines serve Marbo Booster Pump Station No. 3 and other areas of Andersen South.

The HG Range would be in one location at Andersen South for all LFTRC alternatives. The electrical utility in this area consists of DoD overhead 3-phase 13.8 kV distribution lines, the DoD owned Marbo Substation northeast of the HG Range, and the GPA-owned Marbo Combustion Turbine, which is adjacent to the Marbo Substation. The combustion turbine has not been used in approximately 10 years. The substation is operating, but typically unoccupied. These items are within a security fence.

Potable Water

The potable water system near Alternative 1 includes elements of the DoD water transmission and distribution system. This existing functioning system consists of underground water lines, manholes, Marbo Booster Pump Station No. 3, and Marbo Tank No. 4 (460,000 gallons [1,741,289 liters]). The DoD water distribution system at the Andersen South abandoned housing area was also abandoned. Due to elapsed time and lack of use and maintenance, this distribution system within the Andersen South abandoned housing area is deemed unusable and unsalvageable. There is a water main on the road to the former Andersen South housing area from Route 1 to the north, but it is capped at the point of entrance to Andersen South. The GWA has an existing active water line along Route 15.

The HG Range would be in one location at Andersen South for all LFTRC alternatives. There is a raw water line buried in the east/west road to the north of the proposed location of the HG Range. This line collects water from existing groundwater production wells. There are also fire hydrants along that same road. There are no potable water lines near the HG Range.

Wastewater

There is currently no wastewater collection system within the specific Alternative 1 area limits, including the location for the HG Range.

The HG Range would be in one location at Andersen South for all LFTRC alternatives. The closest available operating sewer line for Alternative 1 is to the north along Route 1 and is a GWA asset.

Solid Waste

There are no solid waste facilities near Alternative 1.

The HG Range would be in one location at Andersen South for all LFTRC alternatives. There are no solid waste facilities near the HG Range.

Information Technology and Communications

There is no DoD IT/COMM infrastructure near Alternative 1. There may be commercial IT/COMM routing lines near this alternative, most likely along Route 15.

The HG Range would be in one location at Andersen South for all LFTRC alternatives. There is no DoD IT/COMM infrastructure near the HG Range. Also, there are no known IT/COMM commercial utilities near the HG Range.

5.1.14.2 Environmental Consequences

Electrical Power

There are electrical power system elements along Route 15 within Alternative 1 that would require relocation along with the rerouting of Route 15. This would have direct, short-term impacts on current customers consisting of potential limited power outages during construction. Power outages would be addressed through construction phasing or the use of temporary generators where necessary, which would minimize downtime. The electrical power requirements of the LFTRC facilities would be small (less than

50kW), and thus would have limited impact on the current system or current power customers. The proposed electrical improvements for Alternative 1, as described in Sections 2.5.4.1 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action.

The HG Range would be in one location at Andersen South for all LFTRC alternatives. The power demand from the HG Range would be minimal, so there would be a less than significant direct, long-term impact on the system or current power customers.

The short- and long-term direct impact associated with LFTRC Alternative 1 on the electrical utility would be less than significant, both during construction and in operation.

Potable Water

The proposed water system improvements for Alternative 1 as described in Chapter 2 of this SEIS (for the HG Range) have been developed to meet the requirements for the proposed action. The Range Maintenance Building and the KD Rifle/KD Pistol Range Administrative Building are the only LFTRC facilities requiring water service. A fire hydrant would also be provided for filling range fire fighting vehicles and general fire protection. The potable water demand of the LFTRC would be very small, estimated at an average daily demand of 26,520 gallons per day (100,389 liters per day). Therefore, a less than significant direct, long-term impact on the current DoD water system would occur.

The GWA existing active water line running along Route 15 would need to be realigned with Route 15 construction. Construction practices would be utilized to minimize short-term, direct impacts to the users of this water line. Users could experience short-term water outages as the new routing is switched over to the existing routing. This section of water line would then be new, providing long-term benefit over the current condition of the existing line.

The HG Range does not require water service and there are existing fire hydrants nearby at the Andersen South location. There would be no impact on the potable water resource for this range.

Therefore, short- and long-term, direct impacts associated with Alternative 1 to the potable water utility would be less than significant, both during construction and in operation.

Wastewater

The proposed wastewater collection system improvements for Alternative 1, as described in Sections 2.5.4.1 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The only LFTRC facility requiring sewer service would be the Range Maintenance Building and the KD Rifle/KD Pistol Range Administrative Building that have an estimated wastewater flow of less than 0.01 MGd (0.038 MLd). A new sewer line would be installed and tied into the existing GWA sewer line along Route 1. The estimated sewer flow demand is minimal and would be a less than significant long-term, direct impact. During construction, short-term service outages could occur while the new sewer line is tied into the existing sewer line. With careful planning these potential outages would be minimized. All other LFTRC facilities, including the HG Range, would be provided with portable toilets. These toilets would require periodic emptying, with the sewage then being taken to one of the existing WWTPs for treatment and disposal. The estimated sewage amount is minimal and would not impact the current wastewater resource.

Therefore, short- and long-term, direct impacts associated with Alternative 1 to the wastewater utility would be less than significant both, during construction and in operation.

Solid Waste

The proposed solid waste improvements for Alternative 1, as described in Sections 2.5.4.1 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The estimated long-term solid waste generation for LFTRC operations is minimal, and this additional solid waste would not impact current waste collection, handling, or disposal operations. Suitable solid waste collection containers would be provided within the LFTRC, where required. The solid waste would be periodically collected, handled, and transported to the main cantonment transfer station.

There would be a short-term, direct impact to the solid waste handling effort during the utilities and site improvements (U&SI) construction involving the generation of green waste from clearing and grubbing the range areas and roads, as well as the generation of C&D debris waste. The DON updated the Final Comprehensive Construction and Demolition and Solid Waste Management Plan for Guam Military Relocation, including the green waste management sections. The Utilities and Site Improvement (U&SI) contractor would be required to process/compost green waste on-site. As part of construction waste management, contractors would be required to submit a green waste processing/composting plan to the DON and obtain required solid waste permits for green waste processing and composting from GEPA. The DON would review the contractors' project-specific waste management plans prior to their submittal to GEPA and would provide oversight during the construction. C&D debris generated during the buildup would be handled by the U&SI contractors at a designated laydown area. The U&SI contractor would be required to divert all the green waste and a minimum 60% of the C&D debris from disposal. The larger-sized green waste consisting of trees and stumps would be processed into mulch and the smaller-sized green waste would be processed into compost. The C&D debris would mainly consist of concrete that would be crushed and used as lower-graded aggregate. Construction and demolition debris would be processed for reuse or disposed in permitted facilities in accordance with all regulatory requirements, EOs, and DoD requirements.

The DON proposes to explore ways to resolve key solid waste issues, specifically the status of the Naval Base Guam Landfill permit and handling of special wastes not accepted at Layon Landfill, through the Solid Waste Working Group that was established with USEPA and GEPA on July 24, 2014. During the September 19, 2014 meeting of the Solid Waste Working Group, GEPA indicated that they will formally respond to DON correspondence with regards to issues relative to the Naval Base Guam Landfill. The Layon Landfill and the permitted private hardfill facilities are operating within their regulatory requirements. The proposed action would be in compliance with all applicable GEPA solid waste permit terms and conditions that routinely include specific measures to protect human health and the environment. All other projects on Guam would utilize permitted solid waste management and disposal facilities. The Layon Landfill and the permitted private hardfill facilities are operating within their regulatory requirements. The proposed action would be in compliance with all applicable GEPA solid waste permit terms and conditions that routinely include specific measures to protect human health and the environment. All other projects on Guam would utilize permitted solid waste management and disposal facilities.

Therefore, short- and long-term, direct impacts associated with LFTRC Alternative 1 to the solid waste utility would be less than significant, both during construction and in operations.

Information Technology and Communications

The proposed IT/COMM infrastructure for Alternative 1, as described in Section 2.6, has been developed to meet the requirements for the proposed action. Because there are no existing IT/COMM resources near this LFTRC alternative, there would be no impacts to existing IT/COMM services. There would be inter-

base connectivity required for DoD IT/COMM, as discussed in Section 2.6. Installation of these IT/COMM lines could cause temporary service disruptions to current IT/COMM users, but would be for minimal time durations. New duct banks for Alternative 1 that would be installed include a duct bank of six 4-inch (10-cm) conduits interconnecting the LFTRC range facilities, including the HG Range.

Therefore, short- and long-term direct impacts associated with Alternative 1 to the IT/COMM utility would be less than significant, both during construction and in operation.

5.1.15 Socioeconomics and General Services

Most issues and impacts associated with socioeconomics encompass the entire proposed action (i.e., cantonment/family housing and LFTRC development, increased population), and do not vary with site alternatives. Accordingly, the impact discussion in Section 4.1.15 of this SEIS applies for all of the LFTRC alternatives and is incorporated here by reference. Land acquisition, however, is unique to the LFTRC alternatives, and the amount of land to be acquired varies by alternative. Therefore, this section focuses exclusively on the socioeconomic and sociocultural impacts associated with land acquisition under Alternative 1 (with the exception of the HG Range, which would not require land acquisition).

5.1.15.1 Affected Environment

Table 5.1.15-1 shows baseline data for land that would be acquired for the Route 15 LFTRC alternative. A total of 896 acres (362.6 ha) of land would be acquired by the federal government. Most of the land (676 acres, 273.6 ha) is currently managed by the CLTC and an additional 197 acres (80 ha) are managed by the GALC. The remaining 23 acres (9.3 ha) are owned by GovGuam. No privately-owned land would be acquired under Alternative 1.

Table 5.1.15-1. Potential Changes Due to Land Acquisition, Route 15 LFTRC - Alternative 1

	Acres (ha)
Potential Increase in Federal Land	896 (362.6)
Private Land Potentially Acquired	0
GovGuam Land Potentially Acquired	23 (9.3)
Guam Ancestral Land Commission Land Potentially Acquired	197 (80)
Chamorro Land Trust Commission Land Potentially Acquired	676 (273.6)
Unknown Ownership Land Potentially Acquired	0
	Lots
Number of Lots Potentially Acquired	7
GovGuam Lots Potentially Acquired	3
Guam Ancestral Land Commission Lots Potentially Acquired	1
Chamorro Land Trust Commission Lots Potentially Acquired	3
Private Lots Potentially Acquired	0
Unknown Lot Ownership	0

Table 5.1.15-2 shows existing land use in the Route 15 acquisition area. Land use on the Route 15 parcel is primarily undeveloped in a natural state (73.2%). The developed site raceway park (14%), quarrying resource extraction use, and pre-development site clearing (3.4%) make up most of the remainder. Approximately 13 acres (5.2 ha) are currently used as a road corridor and 3 acres (1.2 ha) are used for subsistence family agriculture.

Table 5.1.15-2. Existing Land Use - Route 15 LFTRC - Alternative 1

Type of Land Use	*Acres (ha)*	*% Total Acreage*
Total Land	**896 (362.6)**	**100%**
Undeveloped Site in Natural State	654 (264)	73.2%
Developed Site Raceway Park	126 (51)	14%
Quarrying Resource Extraction Use	68 (27.5)	7.6%
Pre-Development Site Clearing	30 (12)	3.4%
Road Corridor	13 (5.2)	1.5%
Subsistence Family Agriculture	3 (1.2)	0.3%

Information in Table 5.1.15-3 was provided by GBSP. It shows that the U.S. federal government owns 35,939 acres (14,544 ha) of land on Guam which is approximately 27% of total land on Guam. The DoD has custody and control of most of the federal lands, but there are approximately 1,100 acres (445 ha) of federal land under the custody and control of other agencies, including the NPS, U.S. Postal Service, and the National Weather Service.

Table 5.1.15-3. Summary of Guam Land Ownership

	Acres (ha)	*% of Acreage*
Total	**134,447 (54,543)**	**100%**
Private	72,957 (29,525)	54%
GovGuam	25,581 (10,352)	19%
Federal	35,939 (14,544)	27%
DoD Custody and Control	*34,839 (14,099)*	*25.9%*
Non-DoD Custody and Control	*1,100 (445)*	*0.8%*

Table 5.2.15-4 shows GovGuam property tax revenues collected for FY 2011. These revenues accrue to the GovGuam general fund. In FY 2011, GovGuam collected a total of $20.1 million in property tax revenues.

Table 5.1.15-4. GovGuam Property Tax Revenues, FY 2011

	FY 2011
Property Tax Revenues	$20,147,143

The CLTC has provided a commercial license to the Guam International Raceway Park for a term of 20 years, beginning in 1998, to operate on CLTC land. Table 5.1.15-5 shows the rent schedule for the raceway park. During the years 2015 through 2018, the portion of the term of the lease that would coincide with the proposed action, GovGuam is scheduled to earn approximately $192,000.

The Raceway Park also operates a coral quarry and shares 50% of the profits with the CLTC. Based on information in the CLTC Performance Audit published in 2005, quarry operations provide the CLTC with approximately $70,000 per year. Over the 2015 to 2018 period that remains on the lease, which would coincide with the timing of the proposed action, GovGuam is scheduled to earn approximately $280,000 in association with quarrying revenues.

Table 5.1.15-5. Guam Raceway Park Rental Fee Schedule

Years	*Monthly Rate*	*Total Payments*
1998 - 1999	Waived	$0
1999 - 2000	Waived	$0
2000 - 2001	$1,000	$12,000
2001 - 2002	$2,000	$24,000
2002 - 2003	$3,000	$36,000
2003 - 2008	$3,300	$198,000
2008 - 2013	$3,630	$217,800
2013 - 2018	$4,000	$240,000
	Total	**$727,800**

Source: Guam Office of Public Accountability 2005.

5.1.15.2 Environmental Consequences

The DON is required to comply with federal land acquisition laws and regulations, which include the requirement to offer just compensation to the owner, to provide relocation assistance services and benefits to eligible displaced persons, to treat all owners in a fair and consistent manner, and to attempt first, in all instances, acquisition through negotiated purchase.

The Uniform Relocation Assistance and Real Property Acquisition Policies for Federal and Federally Assisted Programs Act of 1970 (hereinafter the "Uniform Act"), as amended and as enacted through P.L. 91-646, is an important policy that applies to anyone affected by proposed federal land acquisition. This Act provides minimum standards of performance for all federally funded projects that require the acquisition of real property, including the relocation of persons displaced by such acquisition. By law, the federal government is required to offer property owners "just compensation" for their property, which is based on "fair market value" of the property. Fair market value is determined through a federal real property valuation appraisal. The estimated fair market value is used as the basis for acquiring estimates of just compensation. An estimate of just compensation must be established before any property negotiations begin.

Any acquiring agency wishing to begin the process of property appraisal is required to first inform the public. Property owners must be notified that their property is under consideration for acquisition, advised of their legal protections during the process, and invited to accompany the property inspection by an appraiser. This is the initial opportunity for property owners to begin a dialogue with the acquiring agency whereby the owner can confirm ownership and other interests in the property, point out unique amenities, and identify improvements.

Sometimes acquiring agencies do not require the acquisition of entire properties. This is referred to as a partial acquisition. If a partial acquisition creates an "uneconomic remnant," the agency is required to offer to purchase those remnants. In addition, if partial acquisitions cause damages to remaining properties, amounts offered as compensation should include, as a separate line item, compensation for the damages to the remaining property.

Once negotiations have been completed, a property owner is not required to surrender the property until the agreed purchase price is paid by the acquiring agency. Only exceptional cases warrant right-of-entry for the agency prior to making payment, and only upon approval of the owner.

In addition to paying fair market value, the Uniform Act prescribes certain benefits for eligible occupants impacted by federal property acquisitions, including assistance in finding acceptable replacement housing

or business location; the payment of moving and other incidental and miscellaneous expenses; and, as needed, certain supplemental payments for increased housing or rental costs at a replacement location.

While the government is authorized to acquire property through its powers of eminent domain (condemnation), it has been the consistent policy of the DON to acquire real estate through negotiation with owners. Even with a negotiated sale or lease however, "friendly" condemnation may be necessary to clear problems with title. The DON would comply with all applicable laws and regulations, including the Uniform Act.

In general, assuming voluntary sale or lease of property and conformance with land acquisition BMPs, land acquisition impacts from both a socioeconomic and sociocultural perspective would not be considered significant. Should condemnation be necessary as a last resort, while the landowner would be made economically whole by payment of fair market value, such an occurrence could represent an adverse sociocultural impact for that individual landowner. Such instances are expected to be extremely rare or nonexistent during implementation of this proposed action, and collectively would not represent a significant impact.

Socioeconomic and Sociocultural Impacts

Potential impacts associated with land acquisition could affect individual property owners, occupants, the surrounding community, and GovGuam. Economic impacts presented in this section are total impacts, so they include impacts that would be generated by the proposed action both directly and indirectly. Individual owners and occupants might be impacted from an economic perspective or a sociocultural perspective. Economic impacts associated with land acquisition are those that are purely financial. Sociocultural impacts associated with land acquisition are less tangible and are presented broadly in this section under the assumption that conceptual frameworks such as social disarticulation and cultural marginalization (the deterioration of social structures, networks, or belief systems), and social and psychological marginalization, and stress and anxiety (a person's loss of confidence in society and themselves, feelings of injustice, and reduced social status) are valid (see Appendix D, Section 5.2.2 for more detail).

Individual Owner/Occupants

None of the potentially acquired lots at Alternative 1 are privately owned.

Guam International Racing Federation, a CLTC licensee, operates a raceway park that would be affected by land acquisition associated with Alternative 1. If the lease and license are still current at the time of acquisition, the raceway park land use would not be compatible with uses associated with the proposed action. Also, the acquisition of the Route 15 parcel would impact quarrying operations currently operating on those lands, which would be difficult to relocate due to the specific geological requirements associated with quarry operations.

With regard to sociocultural impacts, this alternative would require the acquisition of seven separate lots, all of which are owned by government entities (GovGuam, GALC, and CLTC). Of the lots required, none are privately owned.

Community

Recreation sites within the vicinity of the Route 15 parcel include Guam International Raceway, Marbo Cave, Pågat Trail, Pågat Cave and Village (and Cultural Site), and Taguan Trail. While the revised SDZ avoids direct impacts to Pågat Village and Pågat Cave, there are still potential indirect impacts from firing range noise that could lessen visitor enjoyment of these recreational resources. Also, the Route 15 LFTRC

alternative has been designed to avoid impacting Pågat Village, Cave, and Trail, primarily through the redesigned and reduced footprint for the SDZ both on land and over water.

The Route 15 parcel is classified for agricultural use. However, there are no designated prime farmlands (i.e., lands which are best suited and available for growing crops). Therefore, there would be no impact to agriculture from the loss of prime farmlands.

With regard to sociocultural impacts, the addition of an estimated 896 acres (362.6 ha) of federal land on Guam would be considered by some citizens to be an adverse impact due to the current extent of federal land that is under DoD custody and control (approximately 25.9% of all land on Guam, see Table 5.1.15-3), which would increase to 26.5% with acquisition of the Route 15 parcel. However, because of the DON's commitment to the concept of "net negative," [8] by the end of the Marine Corps relocation there would be no net increase in federal land under the custody and control of the DoD.

Implementation of this alternative would require the closure of Guam International Raceway, resulting in significant direct long-term impacts to recreational resources and less than significant indirect long-term economic impacts related to a potential reduction in tourism. There would also be adverse indirect long-term impacts from a sociocultural perspective due to the potential for the loss of the raceway park to deteriorate social networks. Because groups of people currently use the raceway park for social gatherings, if these gatherings at the raceway park ceased then the related social networks may lose cohesiveness.

Government of Guam

If there is land acquisition of the Route 15 parcel and the Raceway Park license fees are lost, CLTC would stand to lose $192,000 from 2015 to 2018. In addition, if coral quarry operations also ceased in 2015 due to land acquisition, the CLTC would lose a projected profit sharing revenue of $280,000 from 2015 to 2018, based on past revenue stream. Total lost income to the CLTC (between 2015 and 2018), combining lost Raceway license fees and lost profit share from coral quarry operations is a projected $472,000. Because the land acquisition process would compensate for highest and best use, there would be no impact to GovGuam associated with this loss of revenue.

5.1.16 Hazardous Materials and Waste

5.1.16.1 Affected Environment

The ROI for hazardous materials and waste includes the Air Force and privately-owned properties proposed for development of the LFTRC. Air Force properties include Andersen South and privately-owned lands located east of Route 15 between Pågat Cave and AAFB.

Hazardous Materials Management

Route 15 Site

A Phase I Environmental Site Assessment was performed on the site (see hazardous waste management discussion below) and no other potential sources of hazardous materials were in any of the databases searched within the ASTM-specified search distances. However, hazardous materials, predominantly

[8] "Net negative" refers to the February 7, 2011 commitment by the Under Secretary of the Navy that the DoD would have a smaller footprint on Guam at the end of the Marine Corps realignment process (Under Secretary of the Navy 2011).

POLs, are anticipated to be present at the raceway. No underground storage tanks are known to occur on the site.

Andersen South Hand Grenade Range

No hazardous materials are known to be stored in the area of Andersen South proposed for development of the HG Range under this alternative.

Hazardous Waste Management

Route 15 Site

No recognized environmental conditions were identified on the site in the Phase I Environmental Site Assessment report. However, AAFB is a current National Priorities List site. Andersen South, Marbo Annex is part of the AAFB National Priorities List site and is located on one of the northwest adjacent properties. Because this site is a current National Priorities List site and portions of the site are within 1.0 mile (1.6 km) of the subject property, additional investigations have been conducted and have determined that this site has not impacted the Route 15 property (Air Force 2009).

Limited amounts of hazardous waste, predominantly POLs, are anticipated to be present at the raceway due to the nature of the activities conducted there.

Andersen South Hand Grenade Range

The affected environment at Andersen South with regards to hazardous waste management would be the same as described in Section 3.16.1 of this SEIS. No hazardous materials storage or hazardous waste accumulation areas are located in the area of Andersen South proposed for development of the HG Range.

Contaminated Sites

Route 15 Site

Two Areas of Concern (AOC) (AOC 46 and AOC 47) were identified within the vicinity of the Route 15 property and are attributed to AAFB (Figure 5.1.16-1).

AOC 46 is the former location of vehicle batteries. AOC 47 was a number of separate locations where uncontrolled surface dumping occurred including: automobiles, household debris, household appliances, metal debris, electronic equipment, and a soil pile. These sites have been determined to have no effect on the Route 15 property (Air Force 2009).

Additional areas of contamination may be present at the raceway as a result of leaks and spills of POLs during raceway activities (NAVFAC Pacific 2010a).

Andersen South Hand Grenade Range

There are several IRP sites and AOCs located on Andersen South. However, because the development of the HG Range would impact a relatively small area, only one AOC, AOC-64 - SWMU 42C Battery Shop, has the potential to be affected (Figure 5.1.16-1). This active site is associated with the Marbo Power Plant and is described in detail in the 2010 Final EIS (Volume 9: Appendices, Appendix G: EIS Resource Technical Appendix, Chapter 3: Hazardous Materials and Waste Resources, Table 3.6-22 Summary of Applicable SWMUs and AOC Sites on AAFB, page G-3-38 to G-3-43).

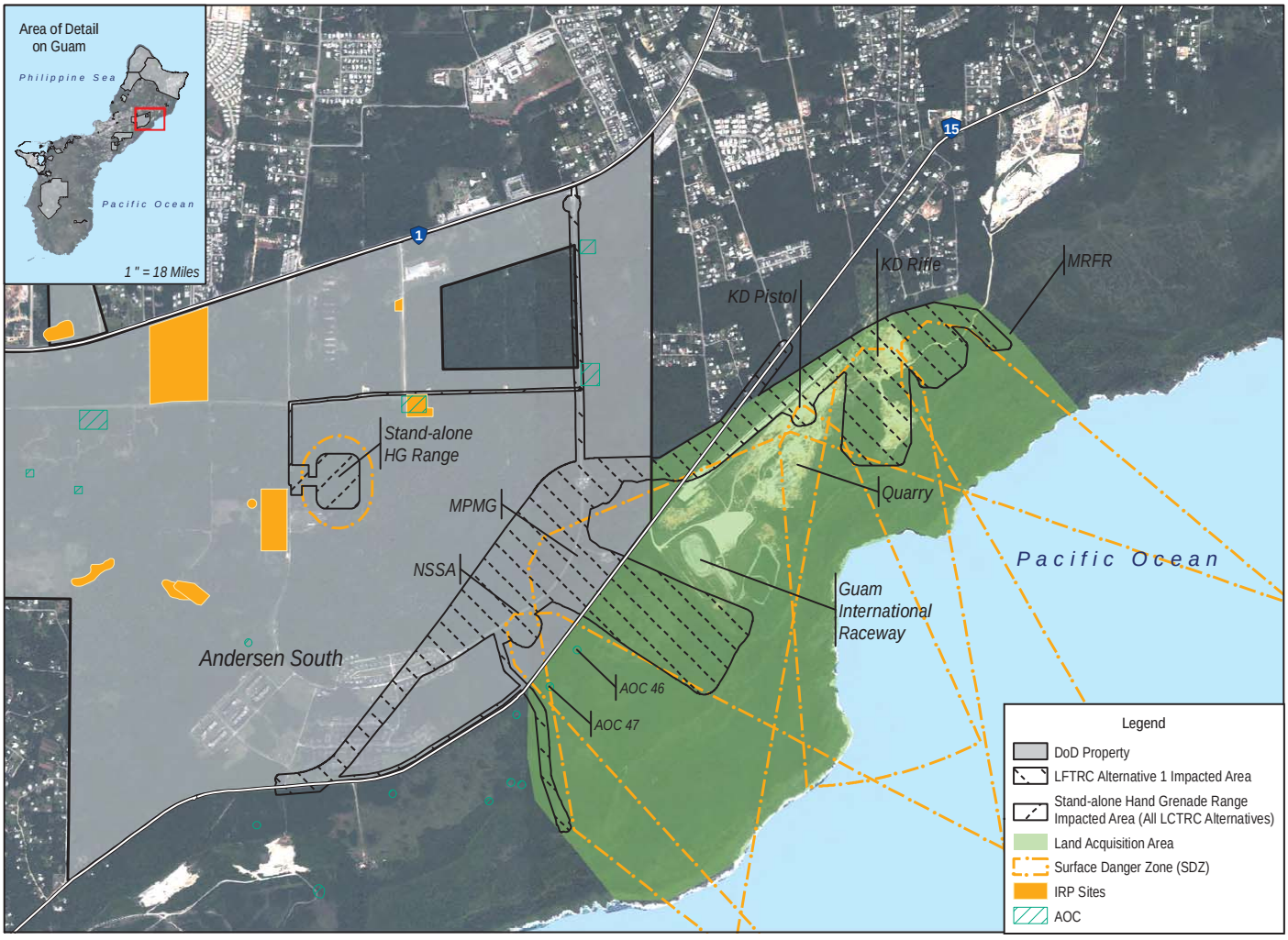


Figure 5.1.16-1
IRP Sites and AOC in the Vicinity of Route 15 LFTRC Alternative 1

Source: NAVFAC Pacific 2013

Toxic Substances

Route 15 Site

There are numerous structures located on the Route 15 site that may be affected by the proposed development of Alternative 1. Any structure constructed prior to 1978 may contain LBP, ACM and PCBs.

Andersen South Hand Grenade Range

The proposed HG Range would include an approximately 1.0 acre (0.4 ha) area that would be developed as an HG training complex for the M67 fragmentation hand grenade. An additional 1.0 acre (0.4 ha) training area would be developed adjacent to the range. The area proposed for development of the LFTRC does not appear to contain any structures. Therefore, LBP, ACM, and PCBs are not likely to be present.

Radon

According to the USEPA, Alternative 1 is located in an area classified as Zone 1 for Radon, indicating average indoor radon levels of greater than 4 pCi/L.

5.1.16.2 Environmental Consequences

Construction

Hazardous Materials and Waste

Construction activities would result in a short-term increase in the use of hazardous materials and generation of hazardous waste that would cease at the completion of construction activity. The majority of the hazardous materials expected to be used are common to construction and include diesel fuel, gasoline, and propane to fuel the construction equipment; hydraulic fluids, oils, and lubricants; welding gases; paints; solvents; adhesives; and batteries. However, the increase in hazardous materials would be handled and waste disposed per the applicable BMPs and SOPs identified in the 2010 Final EIS. Adherence with applicable BMPs and SOPs would reduce the likelihood and volume of accidental releases, allow for accelerated spill response times and enable timely implementation of cleanup measures, thereby minimizing potential impacts to the environment. Therefore, the increase in volume would result in less than significant impacts (see Volume 2, Chapter 17: Hazardous Materials and Waste, Section 17.2.2 Alternative 1, Table 17.2-3: Summary of BMPs and SOPs, pages 17-141 to 17-43 and Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Section 2.1: Best Management Practices on Guam and Tinian, Table 2.1-1. Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23). Adherence to applicable BMPs and SOPs (e.g., erosion control, routine inspections, employee training) would reduce the likelihood and volume of accidental releases, allow for accelerated spill response times and enable timely implementation of cleanup measures, thereby minimizing potential impacts to the environment.

Should there be a need to import off-island earthen materials, all GEPA, Department of Agriculture, and local rules and regulations would be followed.

Construction and demolition contractors would be required to comply with all applicable requirements concerning handling of construction-related hazardous substances. Hazardous materials associated with construction activities would be delivered and stored in a manner that would prevent these materials from leaking, spilling, and potentially polluting soils, ground and surface waters in accordance with applicable federal, state, and local regulations. Public transportation routes would be utilized for the conveyance of hazardous materials to the construction site. Transportation of all materials would be conducted in

compliance with the Department of Transportation regulations. Therefore, less than significant direct or indirect impacts would occur from the short-term increase in the use, transport, storage and handling of hazardous materials and waste during construction.

Construction and demolition activities associated with this alternative would have no long-term impact on the management of hazardous materials at DoD facilities on Guam. Hazardous materials would continue to be managed under established hazardous material SOPs.

Contaminated Sites

Contaminated sites identified under this alternative were determined to either be outside of the proposed construction area and would have no impact on-site conditions, or have been investigated and determined to pose no risk to human health or environmental receptors. Therefore, there would be no direct or indirect impact to IRP/MMRP sites under this alternative during construction.

Toxic Substances

There are numerous structures located on the Route 15 site that may be affected by the proposed development of this LFTRC alternative. Any structure constructed prior to 1978 may contain LBP, ACM, and PCBs. Any facility known or suspected to contain LBP, ACM, and PCBs would be properly surveyed, handled, and materials disposed of in accordance with existing laws and regulations, to ensure there would be less than significant direct or indirect impacts to human health and the environment.

Because the proposed construction areas are located in a USEPA Radon Zone 1, it is possible that new buildings, facilities, and structures could encounter radon intrusion. To minimize this impact, radon resistant construction techniques and abatement systems would be incorporated into the building/facility designs. Therefore, less than significant direct or indirect impacts would occur during construction or operations.

Operation

Hazardous Materials

Live-fire training ranges would experience a long-term increase in the use of hazardous materials from expended training materials resulting from proposed new training. Amounts of expended training materials would increase in rough proportion to the overall increases in these training operations. Activities associated with firing range operations would result in increased hazardous materials in the form of heavy metals. Furthermore, firing range activities would require the use of military transport vehicles and hence a long-term increase in the usage of fuels and POL. It is estimated that firing range operations would result in a long-term increase to the Guam hazardous material disposal rate (2% of the known rate from Marine Corps training on Okinawa), or approximately 640 pounds (290 kg) annually (DRMO Okinawa 2009). For purposes of the impact analysis, it was assumed that the increased volumes of hazardous materials that were considered in the 2010 Final EIS analysis would be reduced because of the generally reduced amount of range operations required for the downsized personnel relocation reflected in this SEIS. The overall reduction in increased use of hazardous materials from range operations under the SEIS alternatives, as compared to the 2010 Final EIS, would be dependent on a variety of factors and cannot be quantified based on available information. Although reduced relative to the 2010 Final EIS volumes of hazardous materials, range operations under Alternative 1 would still represent a substantial long-term increase in the volumes of hazardous material relative to baseline conditions.

Depleted uranium munitions would not be utilized for live-fire training. MCs, in particular heavy metals (lead, nickel, chromium, cadmium, and copper), tend to accumulate in surface soils because of their generally low solubility and their elemental nature. They may oxidize or otherwise react with natural substances, but do not break down in the manner of organic compounds. Therefore, the volume of expended material within the training areas may gradually increase over time (NAVFAC Pacific 2008).

The training range areas under this alternative have limited natural surface waters (see Section 5.1.2, Water Resources). However, range operations under Alternative 1 have the potential to leach MCs to the groundwater. To minimize this potential, range management BMPs would be implemented, as listed in Section 2.8 of this SEIS. As indicated in the 2010 Final EIS, the Route 15 project area overlies the Mangilao Basin and a small portion of the Yigo Basin of the NGLA. Because the NGLA is used as the sole source for drinking water, prior to the construction of the range, site inspection and design/construction information, data from the site survey (preceded by installation of four wells at the NWF LFTRC with associated groundwater sampling and aquifer testing as needed), as well as actual munitions loading data will be provided to the REVA and ORC programs.

The site specific data will be used by those programs to determine the frequency of monitoring and range clearance. For the REVA Program, the site specific data will be used to evaluate the potential impacts to reach potential receptors. This will allow the REVA program to determine whether follow-on actions are required (example: sampling, additional studies, etc.) and the frequency of any further evaluations. REVA will use conservative assumptions and site specific data as available to determine if modeling can be performed for lead components. Monitoring of the ranges for MCs migrating off-range will be based on the outcome of the assessment that is conducted at a minimum every 5 years. The ORC program not only considers the site-specific data and REVA data, but also safety and sustainability considerations in their assessments to determine the frequency of range clearance.

Munitions constituents associated with small arms ammunition commonly used at operational ranges include lead, antimony, copper, and zinc. Lead is the primary munitions constituent indicator for small arms ranges because lead is the most prevalent (by weight) constituent associated with small arms ammunition. No specific quantitative conclusions can be made regarding the fate and transport of lead, because lead is geochemically specific regarding its mobility in the environment. Site-specific conditions are required (i.e., geochemical properties) in order to quantitatively assess lead migration. Site-specific geochemical properties are only identified via sampling and cannot be observed physically. Without site-specific physical and chemical characterization, lead cannot effectively be modeled using fate and transport modeling. The scientific community has established that metallic lead (such as recently fired, un-weathered bullets and shot) generally has low chemical reactivity and low solubility in water and is relatively inactive in the environment under most ambient or everyday conditions. However, a portion of lead deposited on a range may become environmentally active if the right combination of conditions exists.

As indicated in the above paragraphs, a site inspection and site assessment will be completed at the range and the site-specific information provided to the REVA Manager. The REVA manager will utilize this site-specific information in their assessments of the range, which begin the first year of range operation. Assessing small arms ranges first involves defining and documenting its physical and environmental conditions, as well as how the range is utilized and maintained. The assessment process involves a review of possible factors that can influence the potential for lead to migrate off range including range use and management (source), surface water, groundwater and soil conditions, pathways and receptors (including but not limited to people, sensitive and endangered species). Upon review, if factors or a combination of

factors are found to exist that would indicate possible lead migration, REVA program managers consider sampling appropriate media, identifying and implementing BMPs adjustments or taking other steps as required.

The LFTRC and HG Range would be managed in accordance with current Marine Corps range management policies and procedures, which are designed to ensure the safe, efficient, effective, and environmentally sustainable use of the range area. A thorough explanation of Marine Corps range management is detailed in the 2010 Final EIS (Volume 2, Chapter 2: Description of Proposed Action and Alternatives, Section 2.3.1.4: Firing General Military Skills, pages 2-55 to 2-59). The same range service, maintenance, and environmental protection activities presented in the 2010 Final EIS would be applied to the LFTRC and HG Range proposed in this SEIS. Therefore, operational activities associated with this alternative would have no long-term direct or indirect impact on the management of hazardous materials at DoD facilities on Guam.

Hazardous Waste

Military munitions used for their "intended purposes" at an active range are exempt from RCRA regulation per the MMRP (40 CFR 266.202). In general, military munitions become subject to RCRA treatment, transportation, storage, and disposal requirements as solid/hazardous waste when:

- Transported off-range for treatment, storage or disposal.
- Reclaimed and/or treated prior to disposal.
- Buried or land filled on- or off-range.
- Munitions land off-range and are not immediately rendered safe or retrieved.

As long as the proposed firing ranges on Guam remain on "active" or "inactive" status, the MEC on those ranges would be subject to RCRA regulation only if it is "disposed of" by burial on-range or transported off-range for treatment or disposal. Therefore, as long as this range remains "active" or "inactive" only the disposal of MEC associated with range management would contribute to increased hazardous waste volumes.

MEC at closed ranges are classified as solid waste and would likely be hazardous waste. If determined to be hazardous waste the MEC would be classified as a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) hazardous substance and subject to remediation requirements. If removed from the range, MEC would also be subject to Resource Conservation and Recovery Act Subtitle C hazardous waste disposal requirements. MEC would be disposed of at AAFB, which holds a Guam RCRA Operating Permit for a hazardous waste management treatment facility at the extreme reach of Tarague Beach. The hazardous waste management facility is permitted to conduct open burning and open detonation to treat MEC that is either reactive (D003) or toxic as defined by the USEPA. The facility is known as the EOD Range. The Facility Identification Number is GU6571999519 and the Permit Number is GUS002. According to Section II.J of the RCRA Permit, the facility may accept wastes from off-site sources and must use Incident Form 3265 to document and track off-site shipments. In addition to increased MEC, there may be slightly increased generation of hazardous waste as a result of expanded firing range operations. Specific increases in hazardous waste generated could include: pesticides, herbicides, solvents, corrosive or toxic liquids, and aerosols primarily used for firing range maintenance and vehicle maintenance. The 2010 Final EIS (Volume 2, Chapter 17: Hazardous Materials and Waste, Section 17.2.2.2 Training Operations, page 17-252) estimated that firing range operations would result in an increase to the Guam hazardous waste disposal rate of 2% of the known Okinawa rate, or approximately 12,880 pounds (5,842 kg) annually (DRMO Okinawa 2009).

For purposes of the impact analysis, it was assumed that the increased volumes of hazardous wastes that were considered in the 2010 Final EIS analysis would be reduced because of the generally reduced amount of range operations required for the downsized personnel relocation reflected in this SEIS. The overall reduction in increased generation of hazardous wastes from range operations under the SEIS alternatives, as compared to the 2010 Final EIS, would be dependent on a variety of factors and cannot be quantified based on available information. Although reduced relative to the 2010 Final EIS volumes of hazardous wastes, operations under Alternative 1 would still represent and substantial increase in the volumes of hazardous waste relative to baseline conditions. To accommodate the increase in hazardous waste generation, an undetermined number of satellite accumulation sites would be created on DoD property, as needed, in proximity to hazardous waste generation. These areas would be managed in accordance with applicable regulations and the facility Hazardous Waste Management Plan to minimize the likelihood of accidental releases and resulting impacts.

Due to the projected increase in the volume of hazardous waste, this alternative would have the potential to result in impacts to human health and the environment (i.e., soils, surface water, groundwater, air, biota). However, the increase in hazardous waste would be handled and disposed per applicable BMPs and SOPs, and therefore the increase in volume would result in less than significant impacts (see Volume 2, Chapter 17: Hazardous Materials and Waste, Section 17.2.2 Alternative 1, Table 17.2-3: Summary of BMPs and SOPs, pages 17-41 to 17-43 and Volume 7, Chapter 2: Overview of Best Management Practices and Proposed Mitigation Measures, Section 2.1: Best Management Practices on Guam and Tinian, Table 2.1-1. Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23). Adherence to applicable BMPs and SOPs (e.g., erosion control, routine inspections, employee training) would reduce the likelihood and volume of accidental releases, allow for accelerated spill response times and enable timely implementation of cleanup measures, thereby minimizing potential direct or indirect impacts to the environment. Therefore, impacts would be less than significant.

Contaminated Sites

Contaminated sites identified under this alternative were determined to either be outside of the proposed LFTRC area and would have no impact on-site conditions, or have been investigated and determined to pose no risk to human health or environmental receptors. Therefore, there would be no direct or indirect impact to IRP/MMRP sites under this alternative during operations.

Toxic Substances

Because the proposed LFTRC areas are located in a USEPA Radon Zone 1, DoD would periodically test facilities constructed in known radon zones to verify that no unacceptable radon gas buildup occurs, and would install radon abatement systems as appropriate. Therefore, less than significant direct or indirect impacts would occur during operations.

5.1.17 Public Health and Safety

5.1.17.1 Affected Environment

Operational Safety

The affected environment and potential impacts on public health and safety related to the establishment and operation of an LFTRC on Guam include operational safety, environmental health effects (i.e., noise, water quality), hazardous substances, UXO, and transportation. An extensive discussion of the affected environment for public health and safety matters on Guam is provided in the 2010 Final EIS (Volume 2, Chapter 18: Public Health and Safety, Section 18.1: Affected Environment, pages 18-1 to 18-12).

The Marine Corps practices Operational Risk Management as outlined in OPNAVINST 3500.39A/MCO 3500.27A. Requirements in these documents provide a process to maintain readiness in peacetime and achieve success in combat while safeguarding people and resources. The health and safety analysis presented in the following sections addresses issues related to the health and well-being of military personnel and civilians living on Guam in the vicinity of proposed military operations and training areas.

Andersen South open fields and wooded areas are used periodically for basic ground maneuver training including routine training exercises, camp/tent setup, survival skills, land navigation, day/night tactical maneuvers and patrols, blank munitions and pyrotechnics firing, treatment and evaluation of casualties, fire safety, weapons security training, perimeter defense/security, and field equipment training. Vacant single-family housing and vacant dormitories are used for military operations on urban terrain training and small-unit tactics in support of vehicle and foot-based maneuver training. Activities are conducted in accordance with SOPs, for the safety of training participants as well as the general public.

To protect the general public from intentional or accidental entry onto South Andersen property, locked or manned gates are used where vehicle access is provided and a series of warning signs (cautioning unauthorized personnel not to enter the area) are posted along the perimeter of the installation. Unauthorized personnel are not allowed on the installation at any time.

Guam International Raceway is situated on land proposed to be used to support LFTRC development. Periodic events at this raceway include drag racing and off-road vehicle competitions.

Environmental Health Effects

Noise

Andersen South open fields and wooded areas are used for basic ground maneuver training. Noise-generating activities associated with this training include vehicle use, use of breacher charges and pyrotechnics, and small arms firing. These operations are conducted at interior locations within the installation, away from the site boundary, and do not present a noise management issue. Details regarding current noise conditions at Andersen South are provided in Section 5.1.4.1.

The sporting events at the Guam International Raceway generate elevated vehicle noise.

Water Quality

Several water wells are situated within Andersen South or are immediately adjacent to the proposed Route 15 LFTRC boundary. These wells each have a mandated 1,000-foot (305-m) buffer identified as a wellhead protection zone. Within this zone, future activities and development are restricted to avoid contaminants from being introduced in them, and thus protecting the integrity of the island's freshwater aquifers. Guam's freshwater aquifers are susceptible to contamination from surface activities. GEPA requires treatment to ensure water quality meets safe drinking water standards. Section 5.1.2.1 provides details regarding current quality of potable water sources.

Hazardous Substances

Management practices and contingency plans for the use, handling, storage, transportation, and disposition of hazardous substances associated with Andersen South and the Guam International Raceway ensure their exposure to the environment and human contact is minimized.

The IRP focuses on cleaning up releases of hazardous substances that pose risks to the general public and/or the environment. The MMRP focuses on identifying and removing MEC. There are several IRP sites and AOCs located on Andersen South. However, because the development of the HG Range would

impact a relatively small area, only one AOC, AOC-64 (SWMU 42C Battery Shop), has the potential to be affected. This active site is associated with the Marbo Power Plant. The Hazardous Materials and Waste section of this SEIS (see Section 5.1.16) provides additional detail about the status of IRP/MMRP and AOC sites.

Unexploded Ordnance

The presence of UXO within the proposed Route 15 LFTRC area is unknown. However, Guam was an active battlefield during WWII. As a result of the occupation by Japanese forces and the assault by Allied/American forces to retake the island, unexploded military munitions may still remain.

Traffic Incidents

The nearest high crash frequency location in the vicinity of the proposed Alternative 1 is the intersection of Route 1 and Route 6 (approximately 1.5 miles [2.4 km] west of the entrance to Andersen South). It has been identified by the GPD as an intersection with a high rate of traffic incidents.

5.1.17.2 Environmental Consequences

Operational Safety

Construction Safety

Potential impacts on public health and safety from short-term construction activities would be similar to those discussed for the cantonment/family housing alternatives in Chapter 4. During construction activities, a health and safety program would be implemented by the construction contractors based on industry standards for accident prevention. Because a health and safety program would be implemented for construction activities and the general public would be excluded from entering construction areas, potential short-term construction impacts on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to construction activities is anticipated.

Operations/Range Safety

To protect the general public from intentional or accidental entry onto live-fire training ranges, a series of warning signs cautioning unauthorized personnel not to enter the area would be posted along the perimeter of the installation as well as at the range area. Unauthorized personnel would not be allowed on the installation or range at any time. Civilian watercraft may inadvertently enter portions of the SDZ that extend over nearshore waters. Two Range Observation Towers would be erected to provide surveillance of the nearshore SDZ. Live-fire training would cease if the SDZ is penetrated by watercraft and would resume once the watercraft cleared the SDZ.

Activities within the LFTRC would include training to maintain military skills. The training would involve the firing of munitions; individual weapons training and combat skills; and crew, unit, and specialty combat skills.

The safety of the general public as well as personnel participating in military training events is a primary consideration for training activities. The fundamental guidance adhered to during training is that the range must be able to safely contain the hazard footprints of the weapons and equipment employed. The Range Safety Officer would ensure that hazardous areas are clear of personnel during training activities. After a live-fire event, the participating unit would ensure that weapons are safe and clear of live rounds.

Before training activities are conducted, SOPs require that the general public and non-participating personnel be cleared from the area. Therefore, the only public health and safety issue would be if a

training event exceeded the safety area boundaries. However, rules and procedures would be in place to eliminate the possibility of training events exceeding the safety area boundary. Direct risks to public health and safety would be reduced by confirming that the training area is clear.

Possible interactions between training activities within nearshore areas would be minimized by ensuring that the area is clear. Recreational diving activities within nearshore areas take place primarily at known diving sites, and dive boats typically are well-marked with diver down flags. The Marine Corps also may notify the general public of training activities through Notices to Airmen and Notices to Mariners.

Public notification of training activities, controlled use of established training areas, and compliance with appropriate range safety procedures would reduce the potential for interaction between the general public and personnel that are training. Specific and documented procedures would be in place so that the public would not be endangered by training activities. Therefore, Alternative 1 would result in no direct or indirect impact on public health and safety (resulting from operations and training activities).

Explosive Safety

For Alternative 1, SDZs have been defined for each of the ranges in the proposed LFTRC to identify the areas requiring control of unauthorized access to live-fire training operations. An SDZ defines the ground and airspace needed to laterally and vertically contain projectiles, fragments, debris, and components associated with the firing of surface-to-surface weapons. The DoD standard for risk acceptance on ranges is a 99.9999% level of containment, which means the probability of munitions (for inert ordnance) or a hazardous fragment (for live ordnance) escaping the SDZ is one in a million. SDZs established for Alternative 1 reflect a maximum potential adverse effect scenario for weapons use, to ensure the safety of on- and off-range personnel and civilians. The proposed layout of the SDZs is provided in Chapter 2. With implementation of appropriate range safety procedures, no impact on public health and safety is anticipated from Alternative 1 operations.

Ordnance used at Alternative 1 would be handled, stored, and transported in accordance with Marine Corps explosive safety directives (MCO P8020.10A, *Marine Corps Ammunition Management and Explosives Safety Policy Manual*), and munitions handling would be carried out by trained, qualified personnel. Therefore, no direct or indirect impacts related to explosive safety are anticipated.

Environmental Health Effects

Noise

Increases in noise emissions associated with implementation of the short-term construction phase of this alternative with identified BMPs would be less than significant. Enforcement of OSHA guidelines for hearing protection for workers would be the responsibility of the construction contractor. Alternative 1 activities would expose areas to noise levels considered incompatible with residential use. Noise from Alternative 1 activities (i.e., weapons firing) would be heard in areas adjacent to the range. Some adjacent lands north of Alternative 1 include residential uses and approximately 88 people could be exposed to incompatible noise levels (see Section 5.1.4.2). The sound generated from Alternative 1 activities would be intermittent (only when training activities occur) and short term.

Based on summaries of previous research (Thompson 1981; Thompson and Fidell 1989), predictions of non-auditory health effects of noise cannot be made. A valid predictive procedure requires: (1) evidence for causality between noise exposure and adverse non-auditory health consequences, and (2) knowledge of a quantitative relationship between amounts of noise exposure (dose) and specific health effects.

Because results of studies of noise on health are equivocal, a lack of sound scientific basis exists for making adequate risk assessments.

Alleged non-auditory health consequences of noise exposure that have been studied include birth defects, low birth weight, psychological illness, cancer, stroke, hypertension, sudden cardiac death, myocardial infarction, and cardiac arrhythmias. Of these, hypertension is the most biologically plausible effect of noise exposure. Noise appears to cause many of the same biochemical and physiological reactions, including temporary elevation of blood pressure, as do many other environmental stressors. These temporary increases in blood pressure are believed to lead to a gradual resetting of the body's blood pressure control system. Over a period of years, permanent hypertension may develop (Peterson *et al.* 1984).

Studies that had controls for multiple factors have shown no, or a very weak, association between noise exposure and non-auditory health effects. This observation holds for studies of occupational and traffic noise as well as for aircraft noise exposure. In contrast to the early reports of two- to six-fold increases in hypertension caused by high industrial noise (Thompson and Fidell 1989), the more rigorously controlled studies of Talbott *et al.* (1985) and van Dijk *et al.* (1987), showed no association between hypertension and prolonged exposure to high levels of occupational noise. Two large prospective collaborative studies of heart disease are of particular interest. To date, cross-sectional data from these studies offer contradictory results. Data from one study showed a slight increase in mean systolic blood pressure in the noisiest compared to the quietest area, while data from the second study showed the lowest mean systolic blood pressure and highest high-density lipoprotein cholesterol (lipoprotein protective of heart disease) for men in the noisiest area (Babisch and Gallacher 1990).

Based on the modeled noise for proposed activities (see Section 5.1.4), the overall direct or indirect impacts associated with noise on public health and safety would be less than significant.

Water Quality

Potential impacts on public health and safety from water quality concerns would be similar to those discussed for the cantonment/family housing alternatives. Although groundwater withdrawal would likely increase, implementation of sustainability practices would reduce the amount of groundwater needed, which would help minimize impacts on groundwater availability. The resulting total annual groundwater withdrawal would be less than the sustainable yield, and monitoring of groundwater chemistry would identify any emerging issues to ensure no harm to the water supply (see Section 5.1.2.2). Water wells on and adjacent to Andersen South have a mandated 1,000-foot (305-m) buffer, identified as a wellhead protection zone. Proposed development and operational activities would be conducted to avoid these zones thereby eliminating the potential for contaminants to be introduced in these areas. Short-term construction activities and long-term operational activities associated with this alternative would be implemented in accordance with SOPs and BMPs, and in accordance with applicable regulations.

Because measures would be taken to maintain a sustainable water supply and water well locations would be protected from future development and operational activities, public health and safety impacts from long-term increased demand on potable water and potential water-related illnesses would be less than significant.

Hazardous Substances

Potential safety impacts from use of hazardous substances would be similar to those discussed for the cantonment/family housing alternatives. Implementation of this alternative would result in an increase in the use, handling, storage, transportation, and disposition of hazardous substances. These activities would

be conducted in accordance with applicable hazardous material and waste regulations, and established BMPs and SOPs to ensure that the health and safety of workers and the general public was maintained. IRP/MMRP and AOC investigations and/or remediation activities, as necessary, would continue in an effort to clean up past releases of hazardous substances that pose a risk to the general public and the environment and would receive regulator concurrence that necessary actions are completed to ensure the safety of the general public. Because hazardous substance management and IRP/MMRP investigative/cleanup activities would be conducted in accordance with applicable regulations and established BMPs and SOPs, no direct or indirect impact on public health and safety is anticipated.

With regard to exposure to airborne toxic dust related to live-fire training activities and range maintenance, lead is the primary contaminant of concern. Very small lead particles can become airborne if wind, foot traffic, or maintenance activities disturb lead-contaminated soil. Airborne particles smaller than 10 microns can be inhaled and fine particles smaller than 250 microns can be ingested incidentally. Intake of lead through inhalation usually is minor (Air Force 1998). Firing ranges would be designed and constructed so that participating personnel are not exposed to airborne contaminants above permissible limits. As a result, any emissions migrating off-range would likely be much lower. OSHA has established the permissible exposure limit for airborne lead as 50 $\mu g/m^3$ (Air Force 2011). Analysis of firing range emissions presented in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.2.7: Summary of Impacts, Table 5.2-8: Summary of Training Impacts - Firing Range Alternatives page 5-36) indicated that operations emissions from firing range components would be well below significance criteria. Because range maintenance procedures ensure that participating personnel are not exposed to airborne contaminants above permissible limits and analysis of firing range emissions are below significance criteria, a less than significant direct or indirect impact on public health and safety from firing range activities is anticipated.

Unexploded Ordnance

Potential impacts from UXO would be similar to those discussed for the cantonment/family housing alternatives. Excavation for building foundations, roads, underground utilities, and other infrastructure could encounter unexploded military munitions in the form of UXO, DMM, and/or MPPEH. Exposure to MEC could result in death or injury to workers. With the exception of public access provisions outlined through the 2011 PA process (see Section 4.4.10, Cultural Resources), the general public would be excluded from entering construction zones and training areas. To reduce the potential hazards related to the exposure to MEC, ESS documentation would be prepared to outline specific measures that would be implemented to ensure the safety of workers and the general public. BMPs that would be implemented would include having qualified UXO personnel perform surveys to identify and remove potential MEC items before beginning ground-disturbing activities. Additional safety precautions would include having UXO personnel supervision during earth-moving activities and providing MEC awareness training to construction personnel involved in grading and excavations before and during ground-disturbing activities. In addition, the DON provides MEC awareness training to GovGuam and other public representatives allowing access to project sites to facilitate surveys or collection of natural resources or items of cultural significance prior to conducting vegetation clearance. Because UXO would be identified and removed before beginning construction activities and construction personnel would be trained about the hazards associated with unexploded military munitions, potential direct or indirect impacts from encounters with UXO would be minimized and would be less than significant.

Traffic Incidents

During scoping, concern was raised that because the Guam International Raceway would be removed to allow construction of the LFTRC, individuals would resort to local highways to conduct "drag racing" activities. This assumption is speculative. Such activities would be contrary to local traffic laws, and they would be highly dangerous not only to individuals participating in such illegal activity, but also to unsuspecting drivers on the road. However, because the venue for hosting legal racing events would be removed, it is possible that illegal forms of racing may increase in frequency on local roadways.

As part of Alternative 1 development, a portion of Route 15 would be realigned to the north, passing through what is now Andersen South. This realignment would interrupt the long, straight portion of Route 15, adjacent to Alternative 1. The elimination of the long, straight portion of Route 15 may reduce the appeal of this roadway for illegal street racing activities.

Overall potential long-term increase in the number of traffic accidents as a result of the increase in island population would be minimal; a less than significant direct or indirect impact on the public health and safety of the citizens of Guam (from traffic incidents) is anticipated.

5.1.18 Environmental Justice and the Protection of Children

5.1.18.1 Affected Environment

The affected environment under the Route 15 LFTRC alternative is considered to be the entire island of Guam, as discussed in Section 4.1.18.1 of this SEIS. The Route 15 LFTRC proposed action under this alternative would be located within the northern region of Guam, as defined in Section 4.1.18.1. The villages of Dededo and Yigo are within this region.

5.1.18.2 Environmental Consequences

Potential impacts to environmental justice populations from the Alternative 1 would be related to noise, recreation, land acquisition, and public health and safety. The impact analysis discussion provided in the following sections is focused primarily on operational impacts of implementing the proposed LFTRC alternative, as LFTRC construction impacts as related to environmental justice would be minimal and short-term, with no measurable effect on Guam's special-status populations.

Noise

Noise generated during LFTRC construction with the potential to affect sensitive receptors would be due to grading and construction activities at the firing lines and at the range operations facilities located closest to the nearest receptors. Graders and scrapers would be approximately 67 dB at the nearest receptor. Construction would be direct but short-term and not exceed construction noise level standards and be considered less than significant.

The main source of noise associated with Alternative 1 would be small arms training at the proposed range complex. For those potential noise impacts from operation of the Route 15 firing ranges in which acceptable noise levels may be exceeded, the use of the potential mitigation measures would reduce noise levels to less than significant levels. Potential mitigation techniques available for reducing the noise impacts may include maintaining the current dense foliage and constructing berms to contain the sound. Maintaining the foliage or constructing the berms, or a combination of both, would reduce noise levels by 10-15 dB. A 10 dB reduction would be sufficient to reduce impacts to below significant levels.

Noise from the proposed HG Range would stay completely within the AAFB boundaries. Therefore, there would be no noise impacts to local residents.

Tier 1: Are there any minorities, low-income, or children populations that would be impacted?

Yes, noise-sensitive land uses within the north region of Guam include multi- and single-family residences, parks, churches, and schools. Racial and ethnic minority and low-income populations and children of the villages of Dededo and Yigo are presently adjacent to the proposed action site.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?

No, special-status populations would not be disproportionately affected by construction and operations related noise impacts from Alternative 1 because the entire region has minority, low-income, and child populations. All residents within the area of noise impacts for this alternative would be affected in the same manner. Therefore, minority and low-income populations would not be disproportionately affected by noise and there would not be disproportionate risks to the health and safety of children as a result of noise.

Recreation

As described in Section 5.1.7, Recreational Resources, there are numerous public recreational resources in northern Guam. Recreational resources that would potentially be affected by implementation of Alternative 1 include: Pågat and Marbo Caves (and the areas surrounding them), Guam International Raceway, and Taguan Trail. Other recreational opportunities in the north of Guam include trails, historic/cultural attractions, beaches/parks, scenic points, diving locations, and others (e.g., golf courses).

Alternative 1 avoids direct impacts to Pågat Village and Pågat Cave, and the potential indirect impacts from training noise on recreational resources is less than significant due to the generally alternating times of military training and peak recreational visitor use on weekends, when training usually does not occur. The use of the proposed LFTRC would result in restricted access to some dive spots, fishing zones and snorkeling areas used by the public. While Pågat Village, Pågat Cave, and Pågat Trail would not be impacted by implementation of this alternative, firing range SDZs would extend over the Pågat Point cultural site and would impact the public's access to this archeological area during Marine Corps training.

In addition to temporary impacts to the access of other recreational resources in the construction area, the construction phase itself would require the closure of the Guam International Raceway. Based on scoping comments and public feedback, loss of the Raceway would have a long-term adverse effect to affect recreational resources in the community. Implementation of this alternative would require the closure of Guam International Raceway and the acquisition or leasing of that parcel, which would result in a significant direct impact to recreational resources. There would also be adverse indirect impacts from a sociocultural perspective due to the potential for the loss of the raceway park to deteriorate social networks. Because groups of people currently use the raceway park for social gatherings, if these gatherings at the raceway park ceased then the related social networks may lose cohesiveness.

Tier 1: Are there any minorities, low-income, or children populations that would be impacted?

Yes, recreational resources are generally used by all people of Guam, which includes a high proportion of racial or ethnic minorities, low-income individuals, and children.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?

No, minority and low-income populations and children would not be disproportionately affected by the increase in demand to recreation areas, because the entire region has a minority or special status

population. All people of Guam would be affected by impacts to recreational resources. Therefore, Alternative 1 would not result in disproportionately high and adverse effects on minority or low-income populations nor would there be disproportionate risks to the health and safety of children.

Land Acquisition

The following were identified as potential sociocultural issues of concern for individual landowners and occupants of land that would be acquired:

- **Land ownership and occupancy** - Although individuals are compensated for the economic value of acquired land (and related expenses), the loss of land is a long-term unplanned event that is disruptive to the owners and occupants of an acquired property who may value that property as an invaluable possession that cannot be replaced with money.
- **Social disarticulation and cultural marginalization** - Social disarticulation means that a person's social capital or social resources are no longer available. Losing social capital or social resources amplifies the impacts of losing other (natural, physical, human) resources.
- **Social and psychological marginalization and stress and anxiety** - Social and psychological marginalization can be an impact of population displacement and relocation. Such impacts occur due to a person's loss of confidence in society and themselves, feelings of injustice and reduced social status associated with economic marginalization (loss of economic power).

Further descriptions of these sociocultural issues and potential related impacts on Guam's residents can be found in Section 5.2.2 of the SIAS (Appendix D).

No privately-owned land would be acquired under Alternative 1, so there would be no impacts to private land ownership. However, due to the extent of the proposed land acquisition and potential increase in federally owned or controlled land on Guam, and a reduction in access to lands of sociocultural and recreational importance, the overall socioeconomic impacts of land acquisition would be significant.

In general, direct and indirect economic impacts from the land acquisition are considered less than significant while indirect sociocultural impacts are considered long-term and significant. Land acquisition due to Alternative 1 may displace owner or non-owner occupants, reducing individual access to land-based resources, and potentially lead to social disarticulation. In addition, the Route 15 parcel includes four CLTC managed lots and one GALC managed lot. Because GALC ancestral lands are lands where qualified ancestral property rights can be accrued, and CLTC lands represent opportunities available for eligible Chamorro applicants, the acquisition of these lands eliminate these potential land uses, resulting in the possibility of cultural marginalization.

Tier 1: Are there any minorities, low-income, or children populations that would be impacted?

Yes, based on the data provided in Section 4.1.18-1, there are minority, low-income, and children populations in northern Guam.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?

No, because all of Guam is considered a racial and ethnic minority population, minorities would not experience disproportionately high and adverse effects due to land acquisition. Because federal regulations regarding land acquisition would ensure that significant economic impacts to landowners and occupants do not occur, low-income populations would not experience disproportionately high and adverse effects due to land acquisition. Land acquisition would not result in health and safety risks that

would disproportionately impact children. Therefore, Alternative 1 would not result in disproportionate land use or socioeconomic impacts to minority and low-income populations or children as a result of land acquisition.

Public Health and Safety

No impacts to public safety are anticipated from operational safety concerns (i.e., explosive safety, electromagnetic safety, construction safety). No impacts to public health and safety are anticipated from management of hazardous substances, and an additional demand to public health services (e.g., hospitals, outpatient clinics) is not anticipated. Less than significant impacts to public safety, from firing range air emissions, are anticipated. Less than significant impacts are anticipated from noise, water quality, and UXO.

Tier 1: Are there any minorities, low-income, or children populations that would be impacted?

Yes, the populations of the villages affected by Alternative 1 have high percentages of racial minorities, low income groups, and children.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?

No, impacts would not be disproportionate because regardless of where the LFTRC is located on Guam, high (relative to the U.S.) percentages of minorities, low-income residents, and children would be affected. As LFTRC alternatives may only occur on Guam (by international treaty), and all of Guam is considered to have a high proportion of minorities, low-income residents, and children, impacts cannot be considered disproportionate.

5.2 NAVAL MAGAZINE (EAST/WEST) LIVE-FIRE TRAINING RANGE COMPLEX - ALTERNATIVE 2

Under Alternative 2, the proposed development of a live-fire training range complex would occur at NAVMAG East/West. Details about this alternative are provided in Section 2.5.4.2 and the proposed site is illustrated in Figure 2.5-3.

5.2.1 Geological and Soil Resources

5.2.1.1 Affected Environment

The affected environment for the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.1.1 of this SEIS.

The affected environment for geological and soil resources associated with Alternative 2 is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.1.5 South, pages 3-26 to 3-28), which is summarized below for reference. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for geological and soil resources, but it would reduce some potential impacts to geological and soil resources that were determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, as described in the analysis of environmental consequences for Alternative 2 below.

Alternative 2 would be located in a topographically rugged, hilly-to-mountainous area in the south-central part of Guam. Within the proposed project footprint, elevations range from approximately 200 feet (61 m) above MSL along the northeastern extent to approximately 520 feet (158 m) MSL along the southern extent of the footprint. To the northwest of the proposed Alternative 2 footprint is Fena Valley Reservoir, and to the west is Mount Almagosa.

The proposed Alternative 2 footprint is underlain by volcanic bedrock. One known minor bedrock fault crosses the footprint and there are multiple others (including one major) in the surrounding area (Figure 5.2.1-1). The soils of Guam are described in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.1.1.3 Geologic Units, Figure 3.1-4 and Table 3.1-1, pages 3-8 to 3-9). Three soil groups cover the majority of the footprint: Ylig clay, Togcha-Akina silty clay, and Akina Badland Association (Figure 5.2.1-2). Depth and drainage capacity of these soil groups vary from very shallow to very deep, and well drained to poorly drained (Young 1988). The Agfayan Clay, Akina-Atate-Silty Clay, and Akina Silty Clay cover the remainder of the footprint. For the latter three groups as a whole, runoff is medium to rapid, and the water erosion hazard is moderate to severe (Young 1988).

The three dominant soil types in the proposed Alternative 2 footprint are considered limited agriculturally-productive soils because of the elevated acidity of these soils. However, these soils support production of watermelons and pineapples (Young 1988). Prime farmland soils, as defined by the USDA, are soils best suited to producing food, seed, forage, fiber and oilseed crops, favorable for economic production and sustained high yield, with minimal inputs of energy and resulting in least damage to the environment (Young 1988). The Togcha component of the Togcha-Akina silty clay group meets the requirements for prime farmland when irrigated (Young 1988).

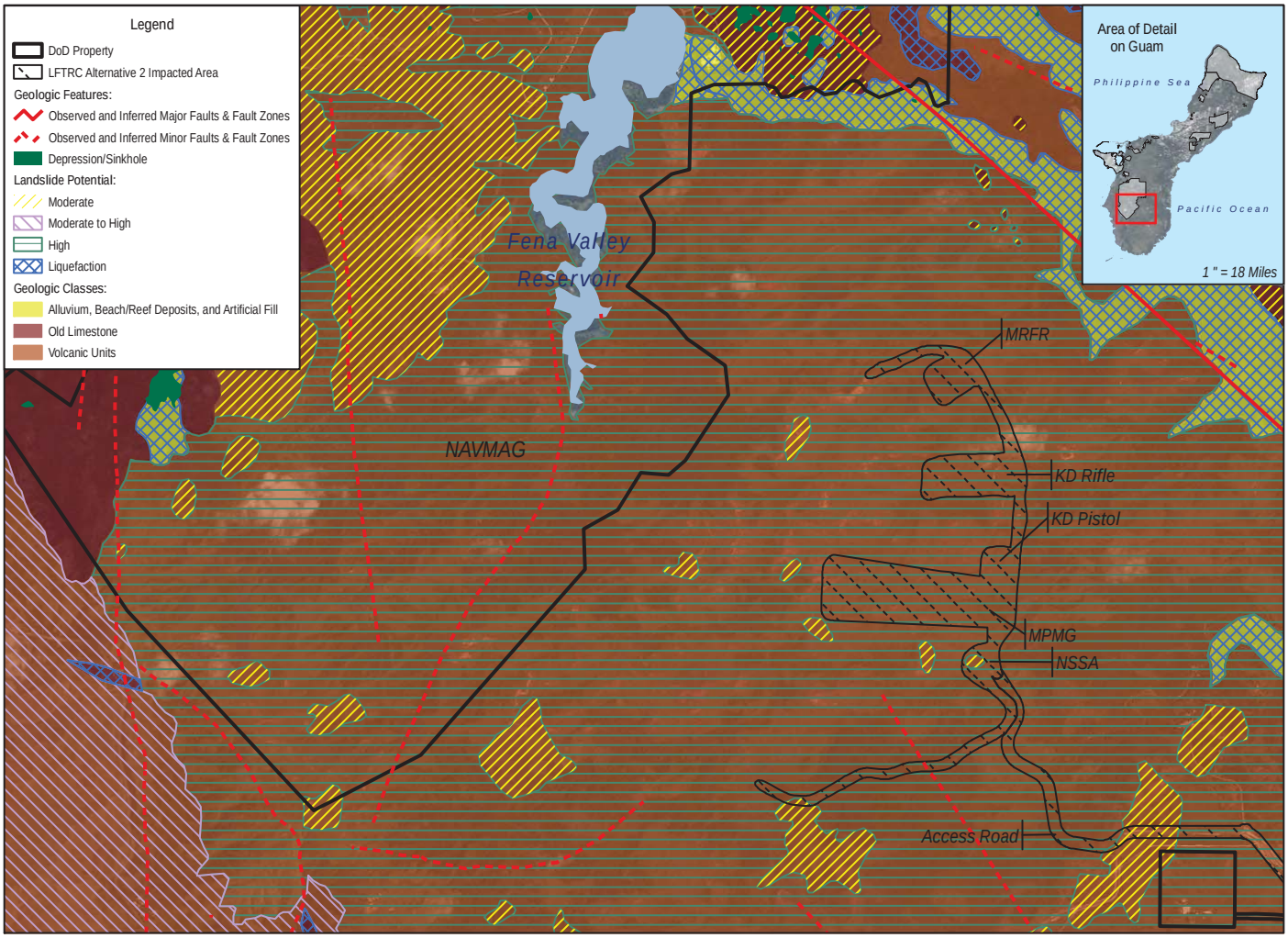


Figure 5.2.1-1
Geologic Features in the Vicinity of
NAVMAG (East/West) LFTRC Alternative 2

Sources: COMNAV Marianas 2008; GovGuam 2008; NAVFAC Pacific 2013; WERI 2001

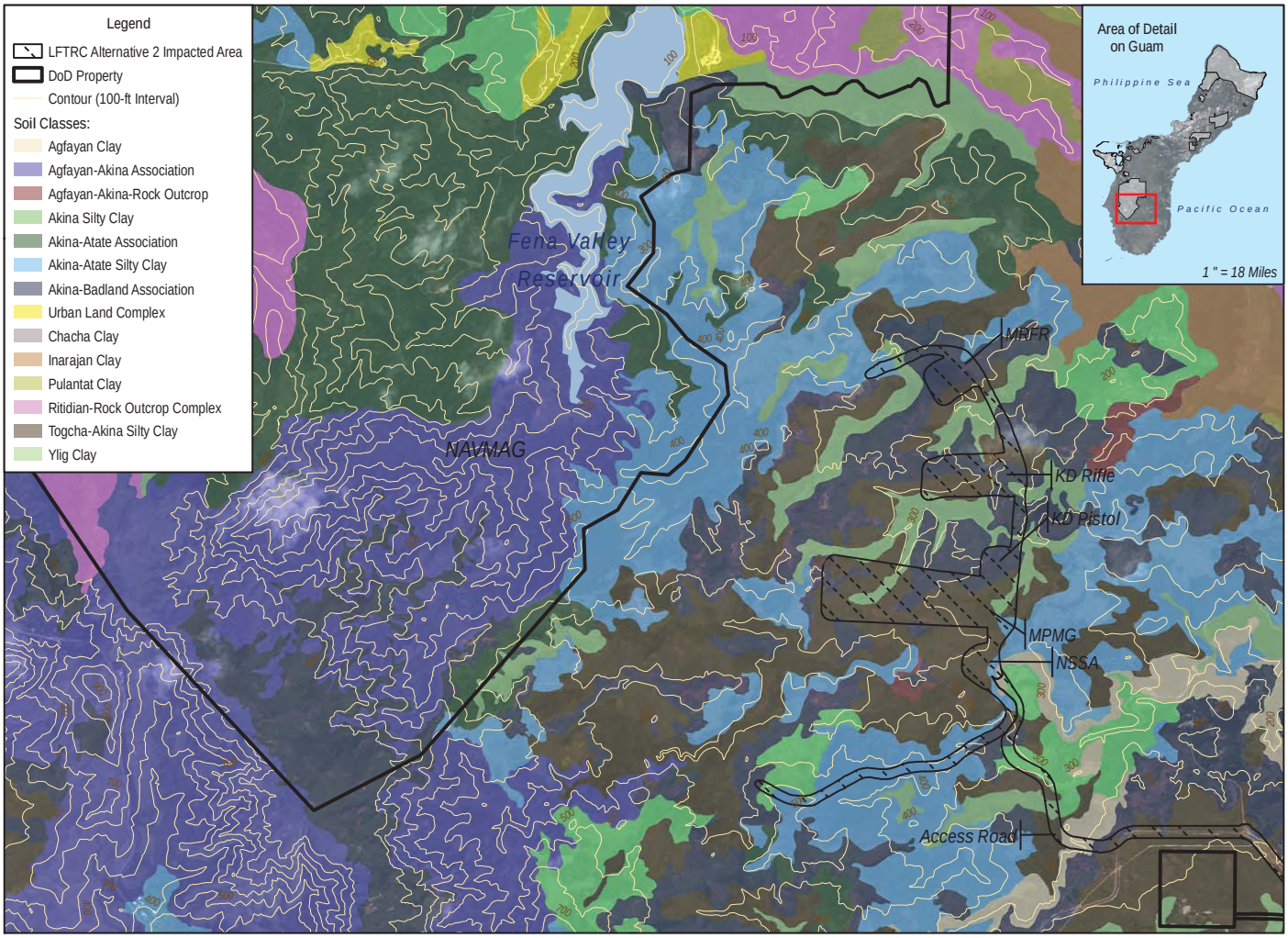


Figure 5.2.1-2
Soils in the Vicinity of
NAVMAG (East/West) LFTRC Alternative 2

With respect to geologic hazards (see Section 3.1.1.1) there is one major bedrock fault mapped within the Alternative 2 footprint. The overall likelihood for landslides to occur is considered high due to many areas combining steep slopes with soils vulnerable to slipping in seismic events (see Figure 5.2.1-1). The maximum reported tsunami waves height reached on Guam was approximately 11.5 feet (3.5 m) in an 1849 tsunami event. The area proposed for development of Alternative 2 is located away from the coastline and above the elevation susceptible to tsunamis. The Alternative 2 footprint is not subject to liquefaction because it is underlain by consolidated volcanic bedrock (see Figure 5.2.1-1). There are no preliminary identified topographic features that may contain sinkholes in the volcanic bedrock underlying the Alternative 2 footprint.

5.2.1.2 Environmental Consequences

Construction

Construction impacts associated with the HG Range at Andersen South would be similar to those described under Alternative 1 in Section 5.1.1.2 of this SEIS.

Construction of the new ranges, range support building, roads, bridges, and related infrastructure associated with Alternative 2 would include clearing, grubbing and grading, and excavation (cut) and filling, and stream rerouting. Earthwork would include 1,246,720 yd^3 (953,186 m^3) of cut (excavation) and 1,254,698 yd^3 (959,286 m^3) of fill, with a net of 7,981 yd^3 (6,102 m^3) of fill. Alternative 2 would involve the least volume of excavation of any of the action alternatives. Within the Alternative 2 footprint, there are 30-feet (10-m) differences in elevation in the areas planned for construction of the MPMG and MRF ranges. There would be substantial changes to surface elevation for construction of the MPMG and MRF ranges. However, at the other four LFTRC alternatives, the locations proposed for the MPMG Range have greater elevation differences than at Alternative 2. For example, at Alternative 2, 30-feet (10-m) high slopes would be leveled with about 942,500 yd^3 and (725,000 m^3) of cut and 910,000 yd^3 (700,000 m^3) of fill. To build the MPMG Range at Alternative 1, 60-foot and 30-foot high (20- and 30- m) slopes would be leveled over the 1,000 m (0.5 mile) length of the range. Nearly the same amount of fill and 2.5 times as much cut would be needed. Because the elevation changes at Alternative 2 are smaller than those of the other alternatives, less excavation, filling and contouring would occur at Alternative 2 so there would be less alteration of the surrounding landscape than at the other four alternatives. Therefore, construction of Alternative 2 is expected to have a less than significant direct, long-term impact on topography. Because the impact to topography would be less than significant, no mitigation measures are proposed.

Construction of the HG Range would involve 8,894 yd^3 (6,800 m^3) of cut and 12,641 yd^3 (9,665 m^3) of fill, for a net of 3,747 yd^3 (2,865 m^3) of fill. Thus, the total net fill for Alternative 2 would be 11,728 yd^3 (8,967 m^3).

There is a potential for increased erosion, compaction, and soil loss from physical disturbance caused by construction activity and changes to existing topography. However, project design and construction would incorporate engineering controls as BMPs to minimize erosion within the project construction footprint, as required by 22 GAR Chapter 10 Guam Soil Erosion and Sediment Control Regulations. Examples of such engineering controls include:

- Use of drainage diversion and control to temporarily direct runoff from adjacent undisturbed areas away from construction sites.
- Use of benches or terraces and drainage control on cut or fill slopes higher than 15 feet (5 m) to minimize erosion on slope faces.

- For each project, limit the size of the unstabilized disturbed areas to less than 20 acres (8 ha) during construction.
- Planning earth-moving operations for periods of low rainfall to minimize exposure of disturbed soil to potential runoff.
- Re-vegetating and permanently stabilizing disturbed areas as soon as possible.
- Engineering project slopes in consideration of soil and geological conditions to avoid and minimize erosion.
- Compliance with the DoD Program-level SWPPP for construction, in addition to individual project SWPPPs during construction to reduce the potential for erosion, runoff, sedimentation, and stormwater pollutant loading.

In addition, construction activities associated with Alternative 2 would comply with the Construction General Permit. Potential construction-specific stormwater BMPs would be implemented in compliance with the Construction General Permit as listed in Section 4.1.2-2. Construction-specific stormwater BMPs would provide erosion and sediment control during the construction period, generally by employing on-site measures that reduce the flow of stormwater and minimize the transport of soils and sediment off-site. Fill material would be generated on-site, whenever possible. Roadway-specific BMPs, as identified in the most recent *CNMI and Guam Stormwater Management Manual*, would be included in the planning, design, and construction of all roadways and facilities. Through compliance with 22 GAR Chapter 10 and the Construction General Permit and implementation of roadway stormwater BMPs, and because the rate of erosion and soil loss would not be substantially increased, direct, short-term impacts to soils from erosion during construction of Alternative 2 would be less than significant. In addition, no indirect, short-term impacts associated with soil erosion are expected.

Construction of Alternative 2 would disturb agriculturally productive soils that are identified by the USDA as prime farmlands. As described in Section 5.2.6 of this SEIS (Land and Submerged Land Use), no existing agricultural use is identified for the area of disturbance. Therefore, disturbance of these soils would be an adverse, but less than significant direct long-term impact.

There are no sinkholes within the proposed Alternative 2 footprint, so no direct or indirect impacts to sinkholes would occur with construction of Alternative 2.

Hazards associated with earthquakes, fault rupture and slope instability would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 (USACE 2013). The NAVMAG (East/West) LFTRC alternative is sited above the elevation prone to tsunamis, and so would not be susceptible to inundation. The volcanic bedrock underlying the site is not vulnerable to liquefaction. In addition, there would not be a change to soil and/or bedrock conditions that would increase vulnerability to a geologic hazard. Therefore, construction of Alternative 2 would result in less than significant direct and indirect short-term impacts with respect to geologic hazards.

Operation

Operational impacts associated with the HG Range at Andersen South would be similar to those described under Alternative 1 in Section 5.1.1.2 of this SEIS.

Operations at the proposed Alternative 2 would not alter topography post construction, so no direct or indirect long-term impacts to topography would occur.

Operational activities and conditions that may directly cause or increase naturally occurring soil erosion at a firing range would include ongoing soil disturbances resulting from vehicular and pedestrian traffic and

inadequate maintenance of vegetated areas. The changes to topography caused by construction of the MPMG and MRF ranges raise the risk of erosion during the operational phase, because graded features (cut and fill slopes), shifted stream channels, and altered surface flow patterns can potentially create conditions that may facilitate additional soil erosion (NAVFAC Pacific 2013a).

The area of impervious surfaces that would be constructed for the ranges and associated infrastructure (range buildings, roads, and parking areas) totals approximately 29.9 acres (12.1 ha) including about 29.0 acres (11.7 ha) for Alternative 2 and about 0.9 acre (0.4 ha) for the HG Range (Appendix F). There would be a minor increase in runoff from the new impervious surface areas as compared with existing conditions. Stormwater infrastructure improvements included as part of the proposed action would incorporate LID measures and BMPs to minimize soil erosion from this increased runoff. Where possible, stormwater flow paths would continue to mimic pre-development flows through area topography. Stormwater BMPs that would be implemented to minimize and control runoff would also minimize soil erosion.

The LFTRC would be managed in accordance with current Marine Corps range management policies and procedures, which are designed to ensure the safe, efficient, effective, and environmentally sustainable use of the range area. A thorough explanation of Marine Corps range management is detailed in the 2010 Final EIS (Volume 2, Chapter 2: Description of Proposed Action and Alternatives, Section 2.3.1.4: Firing General Military Skills, pages 2-55 to 2-59). Marine Corps range management policies and procedures include procedures for removing expended rounds from live-fire ranges with impact berms every 5 years, managing stormwater, controlling erosion, maintaining vegetation on berms and drainage ways and turf on the range, and restricting vehicular activities to designated/previously identified areas. Range roads would be maintained to minimize erosion.

There would be minor ground disturbance associated with utility maintenance. Construction stormwater BMPs would be implemented during maintenance activities to minimize and control runoff on-site and minimize potential effects of erosion.

Prime farmland soils would be disturbed. As described in Section 5.2.1.1 of this SEIS, no existing agricultural use is identified for the area of disturbance. Therefore, disturbance of these soils during the Alternative 2 operational phase would be an adverse, but less than significant, direct long-term impact.

A potential indirect impact of firing range operations includes the possibility of live ammunition causing wildland fires. As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's existing *Wildland Fire Management Plan* (USFS 2008). It would include protocols for monitoring fire conditions and adjusting training as needed. Units undergoing training at the ranges would be briefed by range control on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). The existing *Wildland Fire Management Plan* (USFS 2008) that covers NAVMAG would be extended to cover bordering non-federal lands that could spread fire onto the ranges and would continue to be implemented under Alternative 2. With these measures, potential wildfires caused by the live ammunition would be unlikely. Effects to soils from erosion associated with wildfires associated with operation of Alternative 2 would be minimal and direct and indirect short- and long-term impacts would be less than significant.

With implementation of Marine Corps range management policies and procedures, fire suppression and potential mitigation measures, and stormwater BMPs (for ranges and utility maintenance), and because the rate of erosion and soil loss would not be substantially increased, less than significant direct and indirect long-term impacts to soils from erosion would occur due to Alternative 2 operations.

There are no sinkholes in the volcanic bedrock of the proposed Alternative 2 footprint, so Alternative 2 operations would have no direct or indirect long-term impacts to sinkholes.

Hazards associated with earthquakes, fault rupture and slope instability would be minimized by adherence to UFC 3-310-04 Seismic Design for Building dated June 1, 2013 (USACE 2013) during project design and construction, so direct and indirect long-term impacts with respect to seismic hazards would be less than significant. The consolidated volcanic bedrock underlying the site is not vulnerable to liquefaction. Alternative 2 is inland and higher than the elevation prone to tsunamis, so it would not be susceptible to inundation. In addition, there would not be a change to soil and/or bedrock conditions that would increase vulnerability to a geologic hazard. Therefore, operation of Alternative 2 would have less than significant direct and indirect long-term impacts associated with geologic hazards.

5.2.2 Water Resources

5.2.2.1 Affected Environment

The affected environment for water resources in the Alternative 2 NAVMAG ranges is described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.1.5.1: Naval Munitions Site, pages 4-68 to 4-71). A summary of site conditions for Alternative 2 is provided in Appendix F. The affected environment for the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.1 of this SEIS.

Surface Water

As indicated in the 2010 Final EIS, numerous rivers and a portion of Fena Reservoir are located within the NAVMAG portion of the project area. Numerous rivers are also located in the non-DoD portion of the project area. Specifically, the proposed construction areas and SDZ for the Alternative 2 ranges are spatially located along the Sagge, Sarasa, and Malaja river systems of the southern Talofofo Watershed; the Almagosa, Sadog Gago, and Imong river systems of the Central Talofofo Watershed (*note*: referred to as the "Fena Reservoir Watershed" in the above referenced section of the 2010 Final EIS); and the Bubulao River of the Ugum Watershed (Figures 5.2.2-1 and 5.2.2-2) (NAVFAC Pacific 2013a). The Fena Valley Reservoir is located within the Central Talofofo Watershed.

The watersheds in the Alternative 2 project area are extensively covered by savanna grasslands that can be considered to be highly susceptible to wildland fire. Wildland fires in the savanna grasslands often completely consume the above ground plant cover, leaving the soils exposed to rain and accelerated erosion. Soil erosion can degrade water quality in rivers and Fena Valley Reservoir and over time can diminish the storage capacity of Fena Valley Reservoir. Decades of periodic burning of the savanna plant communities have resulted in severe soil erosion and leaching of essential nutrients. Off-road activity appears to be extensive on non-federal lands, which may further aggravate soil erosion. Overall, the Alternative 2 project area is located on various types of Akina soils, which are characterized by relatively high soil erosion potential and can produce high concentrations of very fine clay suspended sediments (NAVFAC Pacific 2013a).

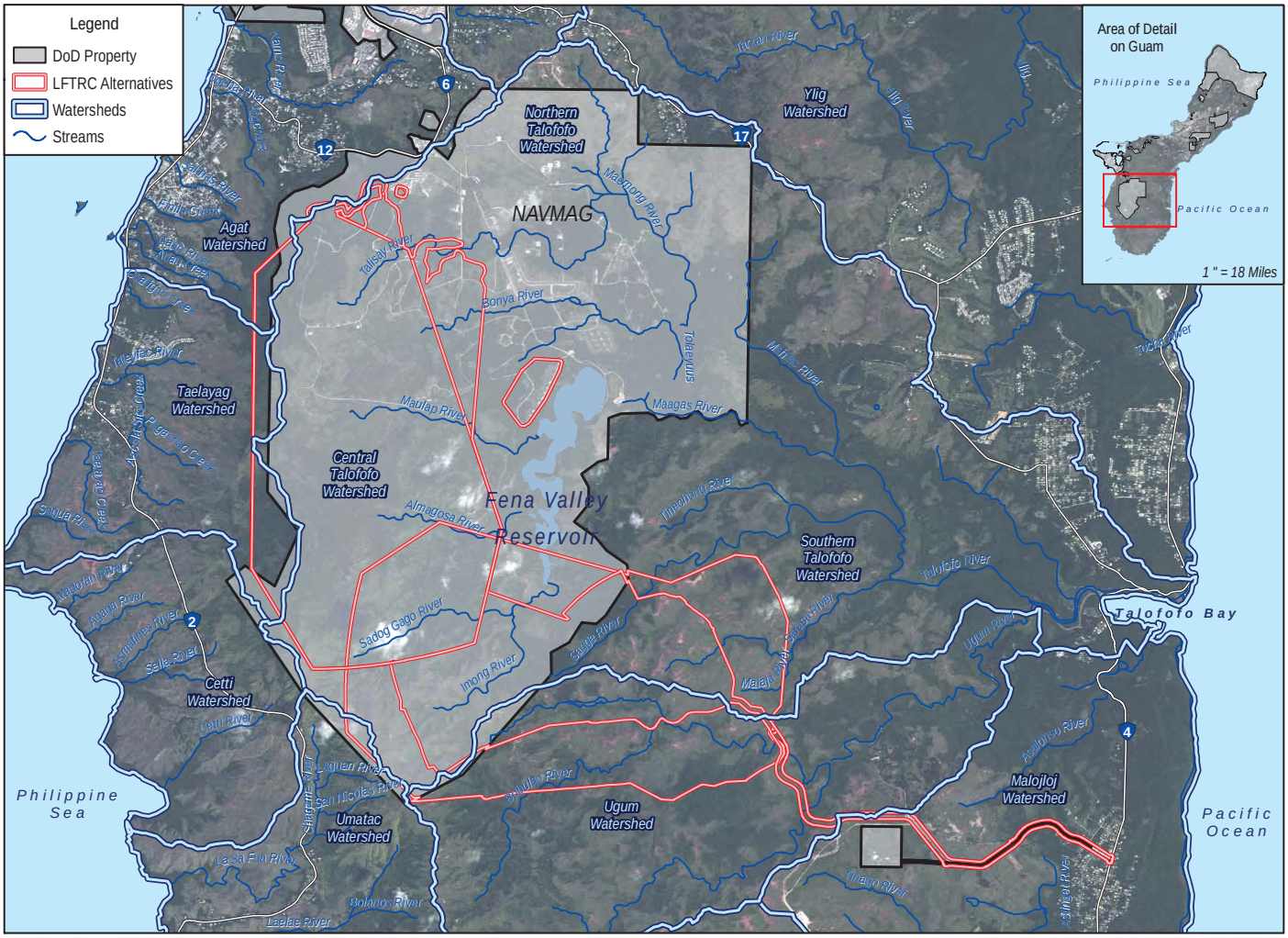


Figure 5.2.2-1
Water Resources in the Vicinity of
All NAVMAG LFTRC Alternatives

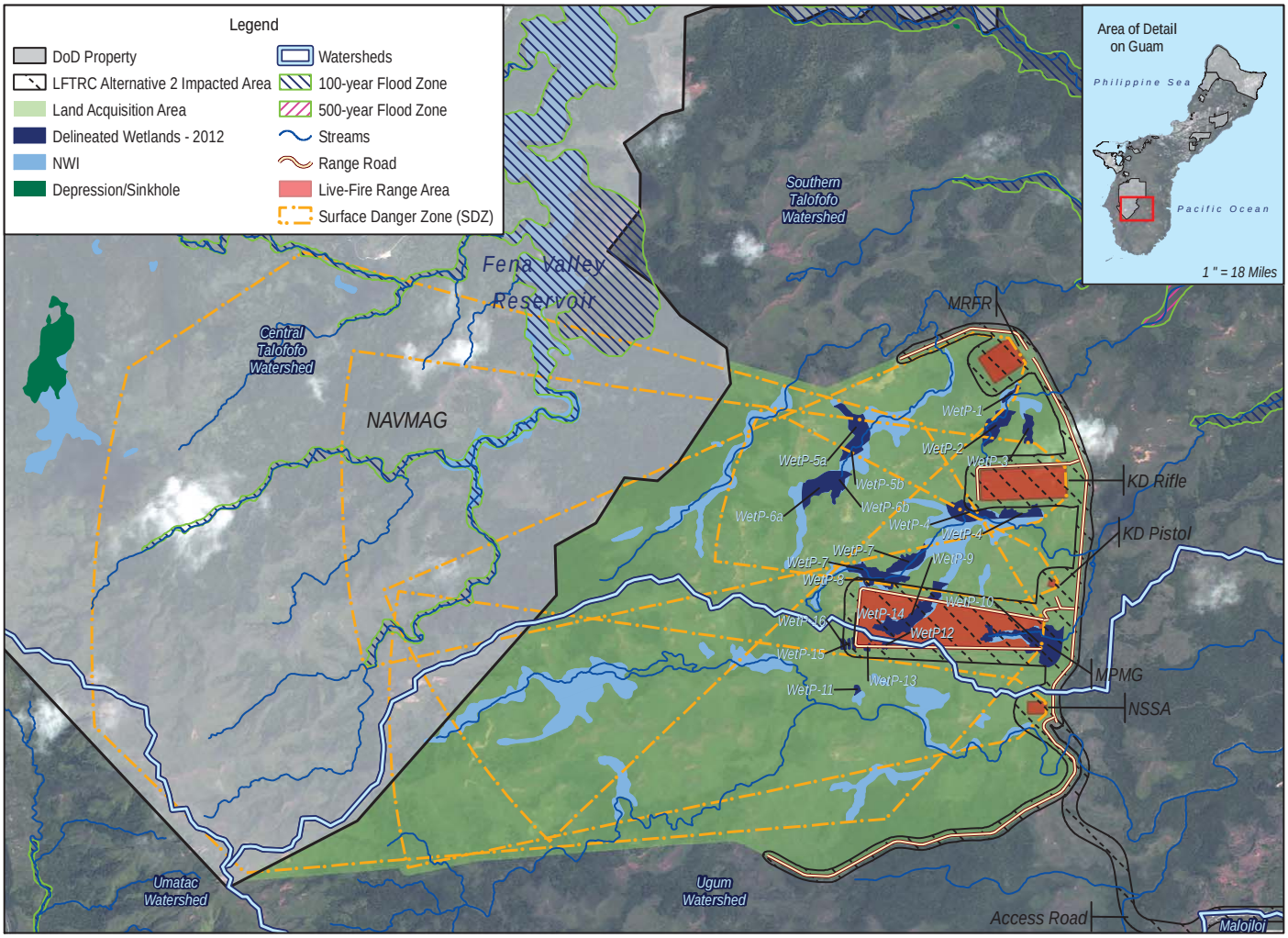


Figure 5.2.2-2
Surface Waters and Wetlands in the Vicinity of
NAVMAG (East/West) LFTRC Alternative 2

Sources: WERI 2001; USGS 2003; FEMA 2007; USFWS 2010; NAVFAC Pacific 2013

Ugum Watershed is included in GEPA's impaired waterbodies 303(d) list for elevated turbidity and USEPA Region 9 approved a TMDL for sediment in the Ugum Watershed in February 2007. The primary pollutant source identified in the TMDL was the nonpoint source from soil erosion. Because the soils of the Ugum Watershed have a very high clay content (40%), much of the eroded soil ends up in the Ugum River and is carried to Talofofo Bay (GEPA 2006). This contributes to poor quality in-stream aquatic habitats, smothering of the coral reefs, and a decline in fish populations (GEPA 2006). The TMDL analysis indicated that sediment loads to waterways in Ugum Watershed would need to be reduced by approximately 25% to attain the TMDL and remedy the impacts of excessive sedimentation on the river. For the Bubulao Watershed (a sub-watershed within the Ugum Watershed) in the project area, annual and daily load allocations to meet the TMDL are 14,000 tons/year (12,700 metric tons/year) and 38 tons/day (34 metric tons/day), respectively (GEPA 2006).

The Federal Emergency Management Agency (FEMA)-mapped 100- and 500-year floodplains are also shown in Figure 5.2.2-2.

Groundwater

As indicated in the 2010 Final EIS, groundwater is found primarily in the low-permeability volcanic rocks and there is currently no groundwater extraction in the Alternative 2 project area.

Nearshore Waters

As indicated in the 2010 Final EIS, there are no nearshore waters located near the Alternative 2 project area due to its interior location on Guam. However, the Ugum River joins the Talofofo River and discharges into Talofofo Bay (see Figure 5.2.2-1). As noted under *Surface Water*, sediment in runoff from these rivers contributes to smothering of the coral reefs and a decline in fish populations (GEPA 2006).

Wetlands

As indicated in the 2010 Final EIS, there are extensive wetlands within the NAVMAG portion of the Alternative 2 project area. Recent on-site wetland confirmation surveys were conducted at NAVMAG in May and November 2012 and at the non-federal lands in May and June 2012 for this SEIS. The on-site confirmation was a non-jurisdictional wetland delineation (delineation being the establishment of wetland boundaries). A jurisdictional delineation establishes the boundaries of wetlands that are subject to requirements in the CWA and its implementing regulations and requires the approval of the USACE.

The wetlands identified during the 2012 survey are palustrine emergent wetlands with persistent vegetation that are either seasonally flooded/saturated (PEM1E) or semi-permanently flooded (PEM1F). The 2012 field survey delineated a total of 17.7 acres (7.2 ha) of wetlands in the project area as shown in Table 5.2.2-1 and Figure 5.2.2-2 (NAVFAC Pacific 2013b). These wetlands are all considered potentially jurisdictional pending a jurisdictional determination by the USACE.

For portions of the project area located outside the 2012 field survey, National Wetlands Inventory (NWI) data were used (NWI maps indicate the potential for wetland areas, but are not official determinations). The NWI maps indicate 3.6 acres (1.4 ha) of NWI wetland areas as shown in Table 5.2.2-1 and Figure 5.2.2-2 (USFWS 2010). The NWI wetlands are identified as palustrine emergent that are semi-permanently flooded (PEM1F) and palustrine forested that are seasonally flooded (PFO3C). The project area outside the 2012 survey area would require a wetland delineation survey and review by the USACE to verify the location and size of any wetlands and whether they are jurisdictional.

Table 5.2.2-1. Summary of Wetland Acreages for Alternative 2

Wetland Type	*Wetland Area (acres [ha])*
Delineated Wetlands within the 2012 Survey Area	
PEM1E*	1.2 (0.5)
PEM1F*	16.5 (6.7)
NWI Wetlands Outside the 2012 Survey Area	
PEM1F*	3.3 (1.3)
PFO3C*	0.3 (0.1)
Total	**21.3 (8.6)**

Note: *Wetland types are based on the classification of Cowardin *et al.* (1979).
Sources: NAVFAC Pacific 2013b; USFWS 2010.

5.2.2.2 Environmental Consequences

Construction

General construction impacts to water resources would be similar to those described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.4: South, page 4-112) and under Alternative A in Section 4.1.2.2 of this SEIS. Alternative 2 would occur in an area that contains waters of the U.S. and would be required to comply with the Construction General Permit as described under Alternative A in Section 4.1.2.2 of this SEIS. Construction impacts associated with the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.2 of this SEIS.

Under Alternative 2, proposed LFTRC construction activities at NAVMAG and non-federal lands would result in the potential for a short-term increase in stormwater runoff, erosion, and sedimentation. However, through compliance with the Construction General Permit Program SWPPP and implementation of a site-specific SWPPP and associated erosion control, runoff reduction, and sediment removal BMPs (see Table 4.1.2-2), these effects would be minimized. Specifically, the site-specific SWPPP would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flowrate of runoff and thereby minimize transport of suspended sediment through settling and promote infiltration of runoff.

Surface Water

Surface waters that are potentially affected by the various project footprints are shown in Figure 5.2.2-2. The MRF Range would drain to the Sagge River and one of its major unnamed tributaries. This unnamed tributary, located south of the Sagge River, would also receive flows from the area proposed for locating the KD Rifle Range. The rest of the area where the proposed KD Rifle Range would be sited would drain through a wetland area to the Sarasa River. The MPMG and the KD Pistol ranges would drain to the Malaja River with small portions of the MPMG Range draining to the Sarasa and Bubulao rivers. The Non-standard Small Arms Range would be located entirely within an area draining to the Bubulao River (NAVFAC Pacific 2013a). The access road would cross the Bubulao and Ugum rivers (see Figure 5.2.2-1). The range roads would cross the Sarasa, Malaja, and Bubulao rivers.

The *Watershed Reconnaissance Study for the Potential Site of the Live Fire Training Ranges Complex, Guam* (hereafter referred to as the *Watershed Reconnaissance Study*) was conducted by NAVFAC Pacific (2013a) to assess potential impacts to surface waters in the Alternative 2 project area and identify BMPs to minimize adverse effects due to construction (see Appendix F). Construction under Alternative 2 would include clearing of vegetation, grading (cut and fill), permanent or temporary accumulation of soils, stream rerouting, and filling in of natural areas. The MRF Range and MPMG Range construction would require substantial amounts of grading.

Potential effects from stormwater runoff would be minimized by adhering to the provisions of the Construction General Permit and implementing of a Program SWPPP and site-specific SWPPP and associated BMPs that would address site- and activity-specific surface water protection requirements. Implementation of construction BMPs under Alternative 2 would also support compliance with load allocations under the sediment TMDL for Ugum Watershed. There would be no construction in the watershed contributing to Fena Valley Reservoir, and therefore no construction-related impacts would occur to the water quality of Fena Valley Reservoir.

Construction activities that involve substantial earth moving would be scheduled for the dry season (January to May), to the extent possible. While rain falls in Guam during the dry season, the rains are usually not as frequent or intense, and the sediment-laden flows from construction areas would therefore be relatively easily managed (NAVFAC Pacific 2013a). Working in and around streams with flowing water would require special consideration because the eroded and/or disturbed sediments would not have to travel too far to enter the regional drainage system. In many of the smaller streams, the dry season characteristically has lower flows or possibly none at all, and therefore work around stream channels would be prioritized for the peak of the dry season. As necessary, flows may have to be re-directed or pumped around the worksite, but this would be temporary and not substantially alter flows. Any permanent relocation of channels or construction of bridges or culverts would also be completed before the start of the rainy season. All bridges and culverts would be designed and constructed so as not to negatively impact the hydrology of surface waters and wetlands. Altered stream banks would be finished, protected, and re-vegetated before the start of the rainy season. Relocating and/or rerouting of natural drainage channels would be subject to USACE Section 404 and GEPA Section 401 permit requirements.

Given the short-term nature of potential surface water impacts, compliance with Construction General Permit requirements, and implementation of BMPs, construction activities associated with Alternative 2 would result in less than significant direct or indirect short-term impacts to surface water.

Groundwater

Construction activities under Alternative 2 would include stormwater runoff protection measures that would also serve to protect groundwater quality. By adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific water resource protection requirements, there would be a reduction in stormwater pollutant loading potential and thus a reduction in pollution loading potential to the underlying groundwater basins. Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs), construction activities associated with Alternative 2 would result in less than significant direct short-term impacts to groundwater.

Nearshore Waters

Construction activities associated with Alternative 2 would occur more than 1 mile (1.6 km) from the coastline and would not result in direct impacts to the nearshore waters from stormwater runoff. Compliance with the Construction General Permit and implementation of BMPs under Alternative 2 would support the compliance with load allocations under the sediment TMDL for Ugum Watershed and ensure that stormwater runoff from the project area would not cause indirect impacts to nearshore waters in Talofofo Bay (see Figure 5.2.2-1). Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs), construction activities associated with Alternative 2 would result in no direct or indirect short-term impacts to nearshore waters.

Wetlands

Implementation of Alternative 2 could result in direct long-term impacts to up to 17.7 acres (7.2 ha) of potentially jurisdictional wetland areas (see Figure 5.2.2-2). These direct impacts would be at the MPMG Range from cut and fill of wetlands associated the Sarasa River and Malaja River. There are an additional 3.6 acres (1.4 ha) of NWI wetlands in portions of the project area that have not been surveyed (see Section 5.2.2.1 in this SEIS).

Direct impacts (fill) to jurisdictional wetlands would be a significant impact. If these wetland areas are determined to be jurisdictional by the USACE, and therefore subject to Section 404 requirements, the Marine Corps would first attempt to avoid impacts. If avoidance is not possible, then the Marine Corps would obtain a Section 404 permit from the USACE to fill the wetlands and comply with minimization and potential mitigation measures outlined in the permit (see Table 5.7-1). Unavoidable direct impacts to jurisdictional wetlands would be mitigated by creating new wetlands, restoring or enhancing existing wetlands, or preserving existing wetland areas on Guam to, at a minimum, replace the area filled at a mitigation ratio greater than 1:1.

As required under the Section 404 permitting process, a mitigation plan would be prepared that would identify sites for compensatory mitigation and include a description of the type(s) and amount(s) of compensation, the method of compensation (i.e., restoration, establishment, enhancement, and/or preservation), and how the resource functions of the compensatory mitigation would address the needs of the watershed, ecoregion, or other geographic area of interest (GBSP 2009). Compensatory mitigation would follow guidelines provided in the *Guam Compensatory Mitigation Policy* (GBSP 2009). The *Guam Compensatory Mitigation Policy* identifies wetland restoration as the preferred compensatory mitigation option and states that "compensatory mitigation should be located within the same watershed as the impact site and should be located where it is most likely to successfully replace lost functions and services, taking into account such watershed-scale features as habitat diversity, habitat connectivity, relationships to hydrologic sources (including the availability of water rights), trends in land use, ecological benefits, and compatibility with adjacent land uses." There are limited opportunities on Guam to restore freshwater wetlands within the same watershed as the impacted site. The Marine Corps has identified the Camp Covington wetlands and portions of the Atantano River wetlands in nearby watersheds as potential Moorhen habitat wetland restoration sites at the Waterfront Annex at Apra Harbor, Naval Base Guam (NAVFAC Pacific 2013c). The suitability of these sites as compensatory mitigation for wetland impacts would be determined during the Section 404 permitting process. Additional sites may also be identified to meet wetland compensatory mitigation requirements.

If Alternative 2 is chosen and wetlands cannot be avoided, the Marine Corps understands that a LEDPA determination must be made as part of the permitting process and that if the USACE determines this alternative is not the LEDPA, a Section 404 permit under the CWA cannot be granted and Alternative 2 would not be implemented. Through implementation of the potential mitigation measures and procedures identified above, significant impacts to wetlands would be reduced to a level below significant. By comparison, Alternatives 1 and 5 would have no impacts to wetlands and Alternatives 3 and 4 would have significant long-term, direct impacts to up to 36.9 acres (15.0 ha) and 25.2 acres (10.2 ha) of potentially jurisdictional wetland areas, respectively, which would be mitigated to a level below significant.

There would also be potentially jurisdictional wetlands adjacent to and downstream of construction areas that would be subject to potential indirect impacts during construction. These short-term, indirect impacts would be minimized by adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific stormwater runoff protection requirements.

Operation

Alternative 2 would incorporate the concept of LID in the final planning, design, and permitting of the stormwater runoff and drainage design as described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-85 to 4-87) and under Alternative A in Section 4.1.2.2 of this SEIS. Operation impacts associated with the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.2 of this SEIS.

Under Alternative 2, there would be a minor increase in the area of impervious surface as a result of ranges and associated support facilities, which would result in an associated increase in stormwater discharge intensities and volume. However, the proposed action would incorporate LID measures and BMPs to ensure stormwater retention would be consistent with local and federal requirements and thus minimize potential impacts to surface water quality. Alternative 2 would also be implemented in accordance with all applicable orders, laws, and regulations including the preparation and implementation of a SWPPP, SWMP, and SPCC plan that would control runoff and minimize potential leaks and spills. Where possible, stormwater flow paths would continue to mimic pre-development flows through area topography.

Alternative 2 would include implementation of the REVA program and range management preventative measures (i.e., vegetation, pH adjustment, LID). As listed in Section 2.8 of this SEIS, the BMPs would reduce the potential for contaminants to migrate off-site. In addition, the DoD would investigate additional technologies that could assist with range design and management to minimize potential impacts. Available baseline data regarding range site conditions would be reviewed and verified prior to range construction and quarterly monitoring would occur during operations to verify the effectiveness of BMPs. For each range, water quality treatment strategies would be selected to achieve reductions of non-point source pollutants to meet the same water quality requirements as identified under Alternative A in Section 4.1.2.2 of this SEIS.

Surface Water

The *Watershed Reconnaissance Study* (NAVFAC Pacific 2013a) identified potential impacts to surface waters during the operational phase of Alternative 2 (see Appendix F). Activities that may directly cause or exacerbate naturally occurring soil erosion and sediment runoff from a firing range would include ongoing soil disturbances resulting from vehicular and pedestrian traffic; inadequate maintenance of vegetated areas; increased stormwater runoff volume and velocity; contamination of stormwater runoff due to eroded sediments, lead, and other MCs; and discharge of untreated contaminated stormwater runoff into surface waters and wetlands. An indirect impact of firing range operations would result from the use of live ammunition causing wildland fires. Large amounts of earthwork at the MRF and MPMG ranges raise the risk of erosion during the operational phase, because graded features (cut and fill slopes), shifted stream channels, and altered flow patterns can potentially create conditions which may facilitate additional soil erosion (NAVFAC Pacific 2013a).

Potential effects from stormwater runoff would be minimized through the implementation of an appropriate and comprehensive stormwater management plan utilizing a LID approach and BMPs under Alternative 2 that would also serve to support the compliance with load allocations under the sediment TMDL for Ugum Watershed. The runoff from operational areas is also the primary mechanism for off-site transport of eroded sediments and potentially harmful MCs, including lead. Firing range operational-phase LID measures and BMPs would focus on reducing volume and velocity of stormwater runoff, minimizing soil erosion potential within the range boundaries, and controlling the spread of lead bullets and bullet fragments. Lead mobilization in stormwater runoff would be of greater concern within the

actual range footprint than within the dispersion area, which may only receive stray bullets (NAVFAC Pacific 2013a). The most effective BMP for managing lead at a firing range is by containing and limiting the spread of the spent munitions. This would be achieved through the use of containment systems, which trap and hold the spent munitions until they can be recovered for off-site disposal (NAVFAC Pacific 2013a). Commonly used spent-munitions containment systems include earthen berms and backstops, sand traps, steel traps, lamella or rubber granule traps, and shock-absorbing concrete. Each type of system would be customized during final design for use at a given range to enhance its effectiveness. The REVA program and additional BMPs listed in Section 2.8 of this SEIS would be implemented to minimize off-site migration of lead contaminants. In addition, the low volume use of explosives during training activities could result in a potential for a very small amount of remaining, non-consumed material to remain in the remaining explosive case. However, these residual compounds would not present a significant threat to water quality due to their relatively low volume of use and the large area in which they would be used.

Appropriate fire suppression and potential mitigation measures would also be incorporated into the design (fire resistant structures) and range operating procedures. These measures would include landscaping with fire-resistant vegetation that can become established in the depleted soils. Overall, Alternative 2 appears to have the highest fire susceptibility compared to the other two NAVMAG alternatives. The likelihood of outside fire sweeping onto the proposed ranges would also be high and would pose an elevated risk to range property and operations. The existing *Wildland Fire Management Plan* (USFS 2008) that covers NAVMAG would be extended to cover the non-federal lands and would continue to be implemented under Alternative 2.

Because none of the proposed Alternative 2 firing range footprints fall within the Central Talofofo Watershed, stormwater runoff from the proposed range footprint areas would not drain to the Fena Valley Reservoir (see Figure 5.2.2-2). However, the SDZ associated with Alternative 2 would partially overlay the Central Talofofo Watershed (see Figure 5.2.2-2), but there would be a very small chance that an expended projectile would fall in the SDZ outside of the range footprint. Given the small number of potential projectiles that could fall into the watershed and the relatively small size of the projectiles, potential impacts to the water quality of Fena Valley Reservoir from these projectiles would be negligible.

No buildings/structures would be constructed in the 100-year or 500-year flood zone. It is anticipated that developing the proposed footprint areas would not impact water surface elevation levels in FEMA-regulated floodplains. However, this would be confirmed through detailed hydraulic and hydrologic modeling during the final design phase. Any rise in the elevations would be covered by FEMA regulations and would need to be approved by the local floodplain administrator.

Alternative 2 operations would be conducted in accordance with all applicable orders, laws, and regulations including the preparation and implementation of a SWPPP, SWMP, and SPCC Plans that would control runoff and minimize potential leaks and spills. Given implementation of these stormwater runoff protective measures and range operation BMPs for containing and limiting the migration of lead contaminants, operations associated with Alternative 2 would result in less than significant direct or indirect long-term impacts to surface water.

Groundwater

Under Alternative 2, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would also serve to protect groundwater quality and recharge. Specifically, implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that any stormwater runoff recharging to groundwater basins would be of

acceptable quality. BMPs to minimize lead transport would minimize contamination of groundwater. Given stormwater runoff protection measures (e.g., implementation of the LID and SWPPP measures), operations associated with Alternative 2 would result in less than significant direct, long-term impacts to groundwater.

Nearshore Waters

Under Alternative 2, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would also prevent direct impacts to the nearshore waters from stormwater runoff. Implementation of LID measures and BMPs under Alternative 2 would support the compliance with load allocations under the sediment TMDL for Ugum Watershed and ensure that stormwater runoff from the project area would not cause indirect impacts to nearshore waters in Talofofo Bay. Given stormwater runoff protection measures (i.e., implementation of LID, BMPs, and pollution prevention plans), operations associated with Alternative 2 would result in no direct or indirect long-term impacts to nearshore waters.

Wetlands

Under Alternative 2, proposed operations have the potential to cause indirect effects to nearby down-gradient wetland areas. However, the stormwater runoff protection measures identified above would also serve to protect water quality entering wetlands. Specifically, implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that the stormwater runoff flowing into wetlands would be of acceptable quality. Given stormwater runoff protection measures (i.e., implementation of LID, BMPs, and pollution prevention plans), operations associated with Alternative 2 would result in less than significant direct or indirect long-term impacts to wetlands.

5.2.3 Air Quality

5.2.3.1 Affected Environment

The areas around the Alternative 2 are not developed and no sensitive populations are present. Ambient air quality conditions in these areas can be considered typical for a rural area and include few activities involving operation of major stationary or mobile sources.

5.2.3.2 Environmental Consequences

The construction activities associated with Alternative 2 would be similar to Alternative 1, with the exception of site location. Therefore, the predicted construction activity annual emissions would be the same as Alternative 1, as summarized in Table 5.1.3-2, and are well below the significance criterion of 250 tpy.

The hot-spot air quality impacts during both construction and operational phases would be similar to Alternative 1, as discussed in Section 5.1.3; resulting in less than significant short- and long-term hot-spot air quality impacts.

5.2.4 Noise

5.2.4.1 Affected Environment

The mountainous southern-central portion of Guam contains Fena Valley Reservoir and NAVMAG with very few people residing in adjacent areas southeast of NAVMAG. Due to the low population and few roads, the only noise source in the area is wind noise. Acoustically, this area would be typical of a rural or wilderness setting with ambient noise levels in this area between 35-45 dBA (USEPA 1978).

5.2.4.2 Environmental Consequences

Construction

There would be no impact due to construction noise under Alternative 2 because construction activities would be in an unpopulated area of Guam. Construction areas would be at least 1 mile (1.6 km) away from the nearest receptors.

Operation

Noise modeling results (Army 2013) for Alternative 2 are shown in Table 5.2.4-1 and Figure 5.2.4-1. Under Alternative 2, the Zone 2 noise levels cover approximately 227 acres (92 ha) beyond the boundaries of NAVMAG and Zone 3 affects about 13 acres (5.4 ha). The affected off-base acreage would extend towards the east and south of NAVMAG in the mountainous region of southern Guam. No houses lie within the noise contours, and therefore no residents would be affected by Zone 2 or Zone 3 noise contours. Table 5.2.4-1 lists the Noise Zones and the associated acreage affected within each zone.

Table 5.2.4-1. Noise Exposure within Noise Zones under LFTRC Alternative 2

Noise Zone (dB DNL)[1]	***Acreage (ha)***		***Population***	
	On-base	***Off-base***	***Houses***	***People***
Noise Zone 2				
65 - 69	500 (202)	175 (71)	0	0
70 - 74	291 (118)	52 (21)	0	0
Total Zone 2	**791 (320)**	**227 (92)**	**0**	**0**
Noise Zone 3				
75 - 79	176 (71)	12 (5)	0	0
80 - 84	122 (49)	1 (0.4)	0	0
85+	191 (77)	0	0	0
Total Zone 3	**489 (197)**	**13 (5.4)**	**0**	**0**
Grand Total	**1,280 (517)**	**240 (97)**	**0**	**0**

Note: [1]Zone 1 is not listed because all land uses are compatible within Zone 1.
Source: Army 2013; NAVFAC Pacific 2013.

Under Alternative 2, no people would be impacted by Zone 2 or 3 noise levels because there are no residences within these zones. There would be no direct impacts due to live-fire training noise under this alternative because there would be no populated residential areas affected and none of the noise significance criteria stated in the Marine Corps Guidance memo for land use and noise exposure would be exceeded (Marine Corps 2005). There would be no direct or indirect impacts because no population would be affected, and none of the impact assessment criteria related to potential noise impacts would be exceeded. As described in Section 5.1.4.2, noise generated levels at the HG Range would remain within Andersen South and noise levels would not impact any residences. In summary, there would be no residences/households affected by noise resulting from implementation of Alternative 2 and, consequently, no significant noise impacts would occur.

In comparison, Alternative 1 is the only LFTRC alternative that would potentially result in significant noise impacts, so the significance of Alternative 2 noise impacts is less than Alternative 1 and the same as Alternatives 3, 4 and 5.

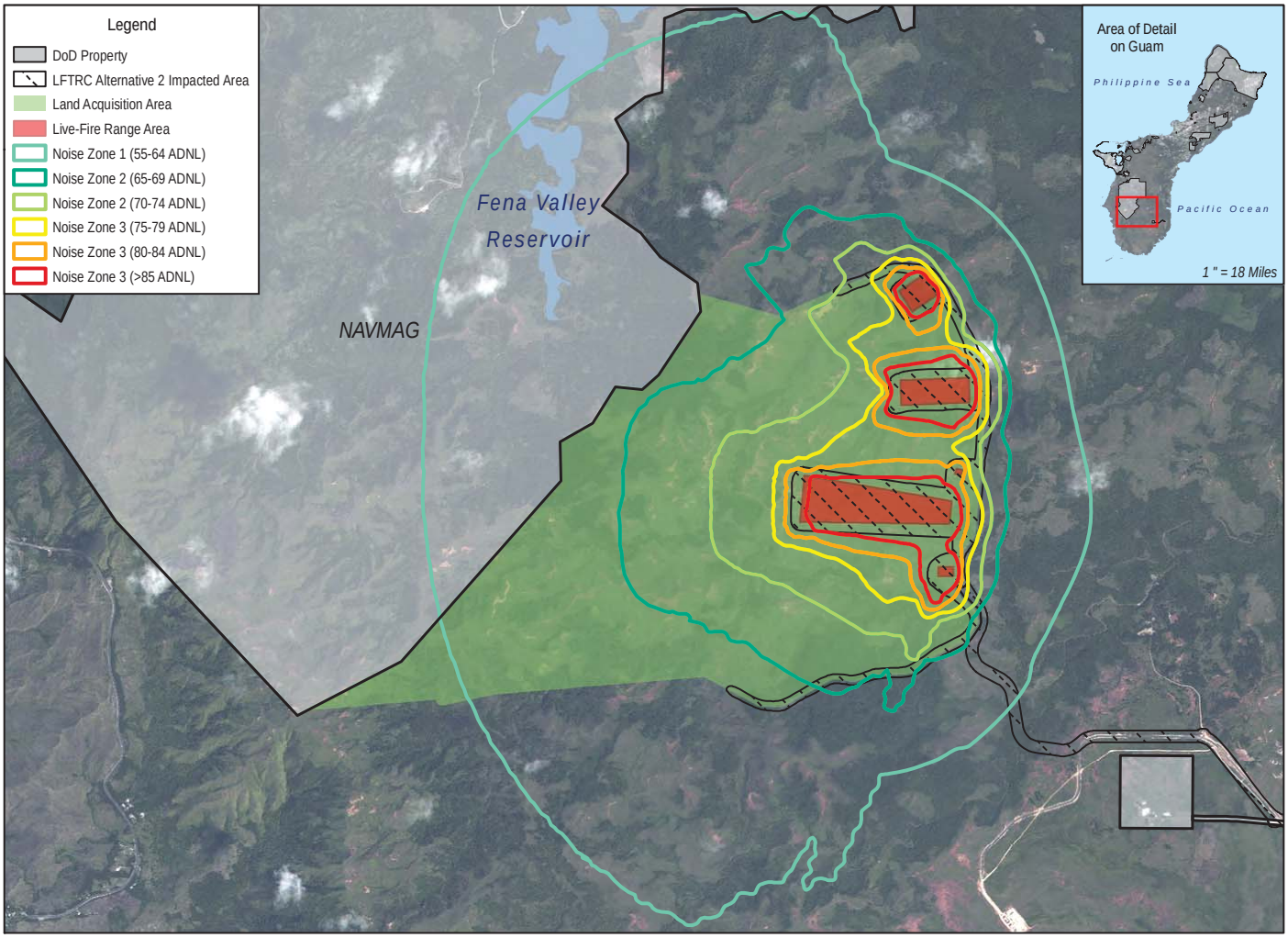


Figure 5.2.4-1
Small Arms ADNL Noise Zones for
NAVMAG (East/West) LFTRC Alternative 2

5.2.5 Airspace

5.2.5.1 Affected Environment

The overall existing airspace conditions for Alternative 2 would be the same as described for Alternative 1 (see Section 5.1.5.1). Detailed information on military and civilian air traffic associated with AAFB and Guam International Airport, respectively, is provided in the 2010 Final EIS (Volume 2, Chapter 7: Airspace, Section 7.1.2: Military Air Traffic, pages 7-8 to 7-10).

5.2.5.2 Environmental Consequences

Construction

No changes to airspace would be required during construction of the LFTRC under Alternative 2. Construction activities would not be expected to conflict or interfere with the use or management of existing airspace in the vicinity. Therefore, construction of the LFTRC under Alternative 2 would have no impact on airspace.

Operation

Figure 5.2.5-1 depicts the proposed Restricted Area associated with the Alternative 2. This SUA would be needed to contain the vertical hazard associated with the proposed live-fire training. Boundary coordinates for the proposed NAVMAG (East/West) Option C of R-7202 Guam would begin at:

- lat.13°20'55"N., long.144°40'34"E
- to lat.13°20'43"N., long.144°43'37"E
- to lat.13°18'54"N., long.144°43'40"E
- to lat.13°18'50"N., long.144°40'32"E
- to the point of beginning

Altitudes, times of use, and controlling and using agencies for this Restricted Area SUA would be the same as described in Section 5.1.5.2 for Route 15 LFTRC Alternative 1. The proposed CFA associated with the HG Range at Andersen South would be the same as described in Section 5.1.5.2 and depicted in Figure 5.1.5-4.

Section 3.5.3.1 identifies the potential impacts to airspace from implementation of the LFTRC alternatives. Given the location of the NAVMAG Complex, the proposed Alternative 2 would directly impact arrivals into and departures out of the Guam International Airport. The FAA stated in the preliminary Airspace Feasibility Assessment (FAA 2013) that Alternative 2 is not feasible. However, the FAA stated that "an assignment of 'not feasible' to a specific alternative is not a statement of infeasibility, but merely an assessment of the airspace in regard to the level of "assumed impact" (FAA 2013).

Operational activities under Alternative 2 have the potential for significant direct, long-term impacts to aviation due to the following:

- Guam International Airport Airspace and instrument approach procedures.
- Standard Instrument Departures and Standard Terminal Arrivals.
- IFR/VFR traffic flows.
- Terminal operations.

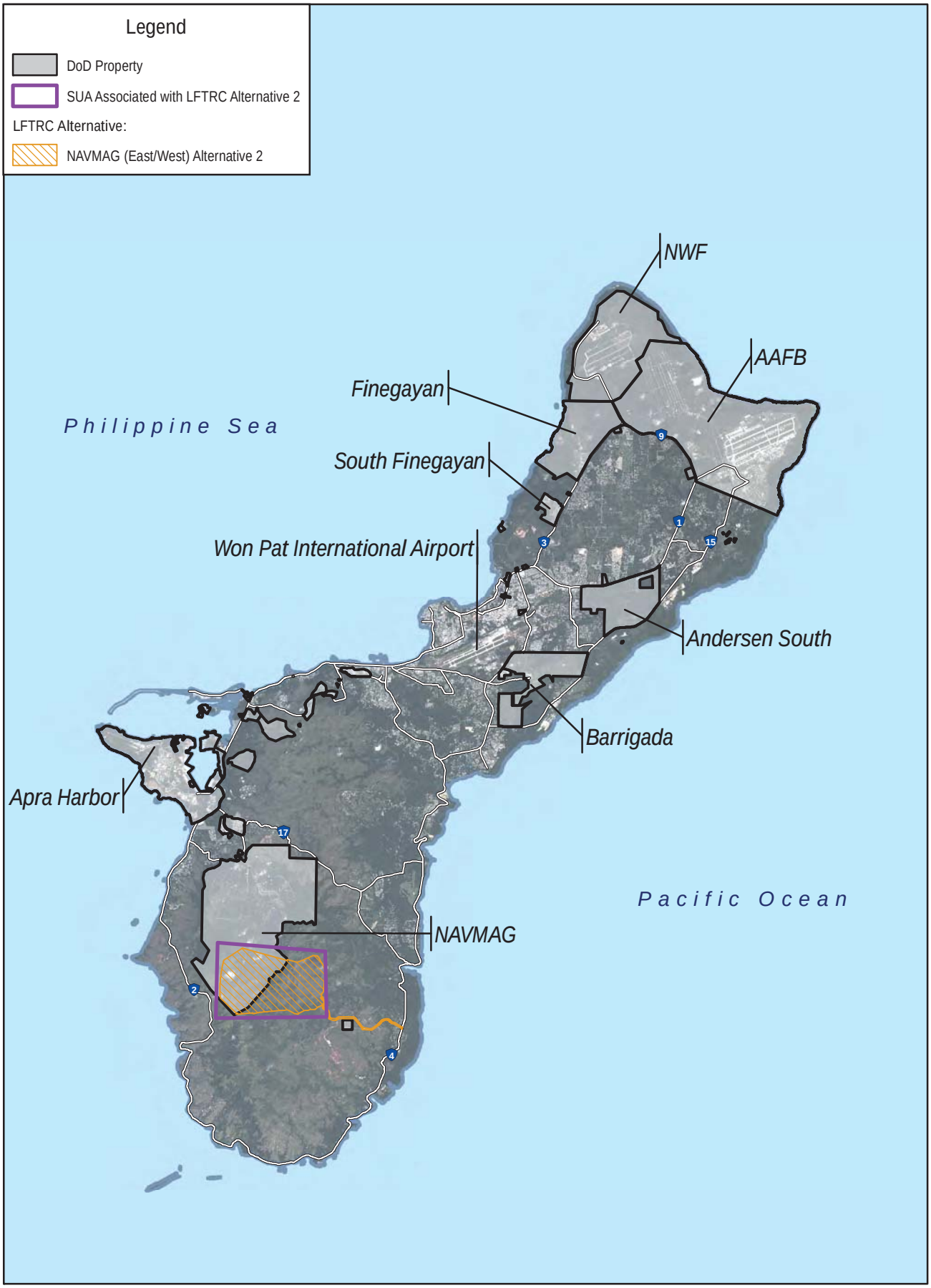


Figure 5.2.5-1
Proposed SUA Associated with LFTRC Alternative 2

However, if this alternative is selected, long-term impacts and potential mitigation would be further studied through the DON/FAA/Air Force consultation process. The general types of potential mitigation measures that could be employed may include adjusting airspace per FAA coordination and/or adjusting LFTRC operation procedures if feasible. However, no potential mitigation measures are proposed at this time.

As detailed in Table 5.7-1, operational impacts under Alternative 2 would be the same as under Alternatives 1, 3, and 4. Operational impacts under Alternative 2 would be greater than impacts under Alternative 5.

5.2.6 Land and Submerged Land Use

5.2.6.1 Affected Environment

The affected environment for the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.6.1 of this SEIS.

The proposed Alternative 2 is partially located on the southern portion of NAVMAG and extends off-base to the east. The proposed land acquisition area is shown on Figure 5.2.6-1. In addition to the land required for the expanded NAVMAG installation boundary, land would be acquired for the access road connection to Route 4 (Figure 5.2.6-1). Most of the land proposed for acquisition is privately owned (Figure 5.2.6-1).

Additional details on the number of lots affected and land ownership is provided in Section 5.2.15, Socioeconomics and General Services. No submerged land is affected by this alternative (Figure 5.2.6-1).

The primary existing land uses for NAVMAG are munitions storage and administration, which occur in the northern portion of NAVMAG. There are existing training activities in NAVMAG including a sniper range, Ordnance Annex Detonation Range, land navigation areas, air training (search and rescue, insertion/extraction). Fena Valley Reservoir water wells are located central-west in NAVMAG. Some of these NAVMAG land uses are shown on Figure 5.2.6-1.

Land use is related to other resource areas that are covered under various sections of this SEIS, such as socioeconomic, recreational or ambient noise. Most of the land proposed for acquisition is undeveloped and in its natural state (Appendix D, SIAS; Figure 5.3-15, Table 5.3-3). There are no community land use plans for the NAVMAG vicinity. The GBSP land classification for the entire acquisition area is Agriculture (see Figure 3.6.1-2). However, as described in the Section 5.2.8, Terrestrial Biological Resources, the acquisition area is within the Guam Bolanos Conservation area, which is under Guam Department of Agriculture jurisdiction. USDA-designated prime and important farmlands were identified within the acquisition area (see Figure 5.2.5-1). No current agricultural use was identified.

Adjacent land uses to the Alternative 2 impacted area are other NAVMAG land uses and non-federal lands that are classified by GBSP as Agricultural (see Figure 3.6.1-2). Mount Lamlam and Mount Jumullong Manglo were identified west of the SDZs, but not adjacent (Figure 5.2.6-1).

The proposed action associated with Alternative 2 includes off-base utility infrastructure and a new access road, as described in Section 2.5.4.2 and summarized in Section 5.2.

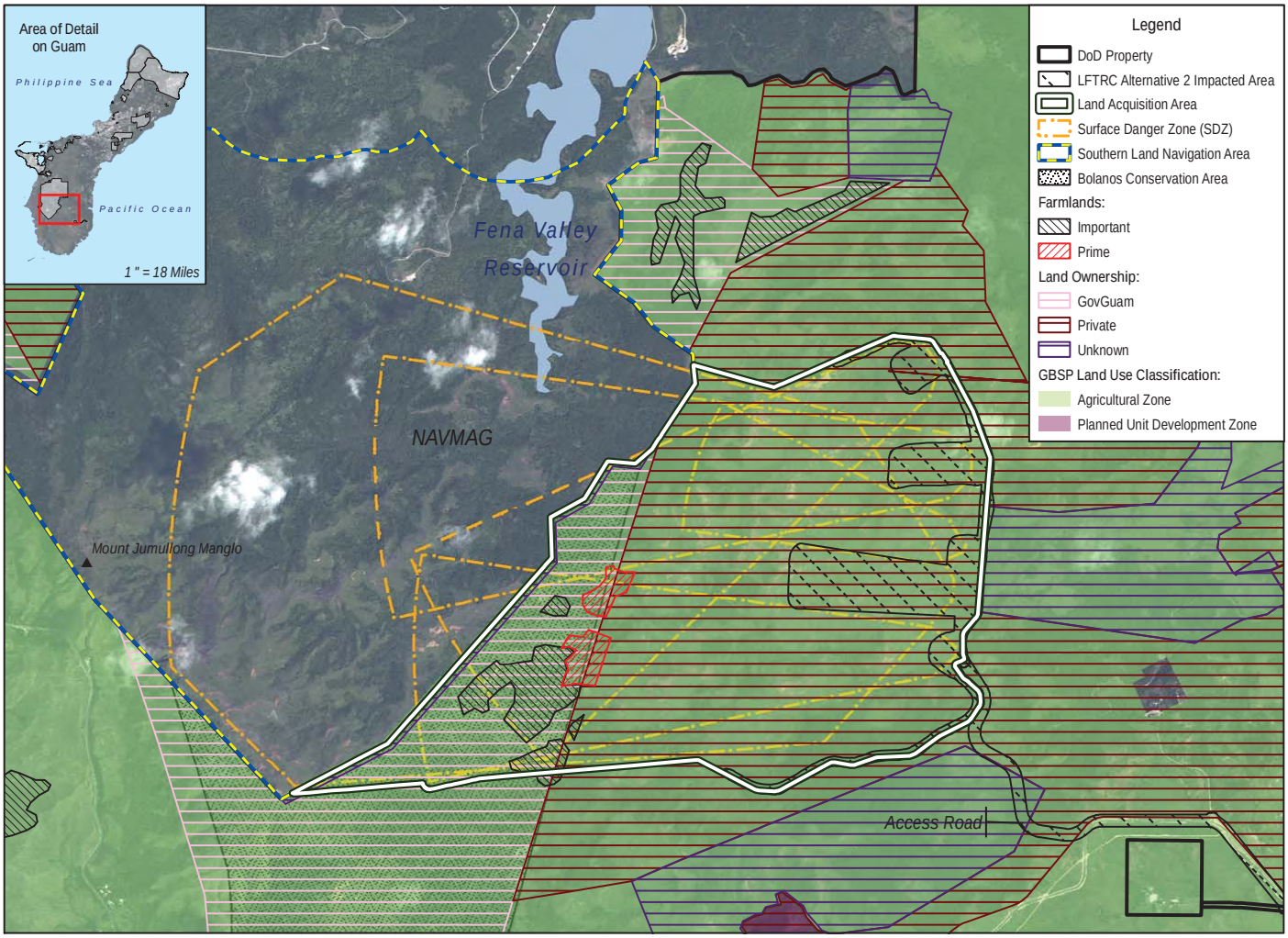


Figure 5.2.6-1
Land Use in the Vicinity of
NAVMAG (East/West) LFTRC Alternative 2

5.2.6.2 Environmental Consequences

Land use impacts are addressed in this section. Land ownership impacts are addressed in Section 5.2.15, Socioeconomics and General Services.

Construction

As previously discussed in Chapter 3, Section 3.6.3.1, Methodology, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource under any of the alternatives.

Operation

Potential impacts on Fena Valley Reservoir and water supply are addressed in the Section 5.2.2, Water Resources. The wellhead protection areas would not be affected. LFTRC land use would be compatible with the existing military NAVMAG land use, except the use of the southern land navigation area would be discontinued. Any direct or indirect land use incompatibility issues related to the military mission within NAVMAG would be resolved through application of installation master planning guidelines outlined in UFC 2-100-01. Therefore, long-term land use impacts would be less than significant.

The acquired area would largely remain as open space. USDA-designated prime and important farmlands were identified within the area but the area is not currently used for agriculture. The long-term loss of approximately 7% of the USDA-designated prime farmland and less than 1% of USDA-designated important farmland on Guam is an indirect adverse impact, but is considered less than significant because it is not currently in agricultural use and there are other prime and important farmlands available for agricultural use.

The proposed Alternative 2 would be compatible with surrounding vacant land use. Zone 3 noise contours would extend slightly off-base into vacant land, as described in the Section 5.2.4.2, Noise. Zone 2 noise contours would also extend beyond the proposed installation boundary, as shown on Figure 5.2.4-1. However, no existing or planned residential land uses (or other sensitive receptors like schools or medical facilities) were identified within the Zone 2 or 3 contours. The acquisition area is designated for Agriculture, which is a compatible land use within the Zone 2 and 3 noise contours. No land use impact due to noise was identified.

The proposed access road/utility easements are compatible with the current vacant land use and GBSP Agriculture classification. The new access road would facilitate public access to remote areas. This new access could be considered both a potential beneficial and adverse direct and long-term impact on adjacent and nearby land use. The landowners may appreciate improved access to their property, but they may also be concerned that a new roadway would facilitate public access.

As addressed in Section 5.2.10.2, Cultural Resources and Section 5.2.7.2, Recreational Resources, Mount Lamlam and Mount Jumullong Manglo public access would not be subject to additional restrictions.

Implementation of Alternative 2 would restrict non-DoD access to a portion of the Bolanos Conservation Area that would be within the land acquisition area. The impact of the reduced access on conservation goals and objectives is primarily a biological resources impact and is addressed in Section 5.2.8, Terrestrial Biological Resources. As described in Section 3.6.3, Approach to Analysis, new access restrictions placed on non-DoD populations is a potential direct and long-term significant impact when a specific community-valued land use is affected.

The following may be a potential mitigation measure to reduce this impact to a less than significant level:

- DoD would work with GovGuam to develop a plan to balance the loss of conservation land use and access with the operational needs and public safety concerns.

Alternatives 2 and 4 would have a similar level of impact to land use resources due to the loss of public access and valued land uses from the Bolanos Conservation Area. However, the significant impacts are potentially mitigable and would have less of an impact than Alternative 1, which has no mitigation proposed. Both Alternatives (2 and 4) would have a greater impact to land use than Alternative 3, which would have less than significant land use impacts.

5.2.7 Recreational Resources

5.2.7.1 Affected Environment

The 2010 Final EIS described the proposed actions to occur at NAVMAG (Volume 2, Chapter 2, Section 2.3: Proposed Action-Training Functions and Section 2.3.1.3: Non-Firing General Military Skills Training Facilities, pages 2-41 to 2-43 and 2-44 to 2-55, respectively). These included proposed non-live fire training and maneuver facilities and operations, as well as the use of the existing hiking trails as an access road to the NAVMAG site. While the current proposed action for live-fire training ranges differs from the 2010 Final EIS actions at NAVMAG, the potentially impacted recreational environment and the recreational resources near NAVMAG remain the same. A list of recreational resources near NAVMAG is contained in the 2010 Final EIS (Volume 2, Chapter 9: Recreational Resources, Section 9.1.5: South, pages 9-14 to 9-18). Comprehensive descriptions of recreational resources near NAVMAG are contained in the 2010 Final EIS (Volume 9, Appendix G, Chapter 1: Recreational Resources, Section 1.4.1: Naval Munitions Site and Section 1.4.2: Non-DoD Land, pages G-1-19 to G-1-28). Access and use of the recreational resources within NAVMAG are restricted to base personnel and guests only. Recreational resources near Alternative 2 are identified in Table 5.2.7-1.

Table 5.2.7-1. Recreational Resources within the Vicinity of Alternative 2

Recreational Resource	*Public Access*
Historic and Cultural Attractions	
Fena Massacre Site	Installation personnel and guests only (open to the public for an annual memorial event)
Scenic Points	
Japanese Lookout	Installation personnel and guests only
Fishing	
Fena Reservoir	Installation personnel and guests only
Parks	
Talofofo Falls Park and Hiking Trails on Non-DoD property	Open to the public
Other	
Almagosa and Dobo Springs and Bonya	Installation personnel and guests only (and public by special request on a limited basis)

Source: DON 2010.

Unlike the 2010 Final EIS NAVMAG action, this option includes ranges and SDZs extending outside NAVMAG property and to the east. The proposed access road would utilize the existing Dandan Road from Highway 4, run parallel to the northern boundary of the Dandan communications site, and then extend west to the ranges on improved all-weather roadways. This expanded footprint does not encompass any additional recreational resources within its boundaries not already described and analyzed in the 2010 Final EIS.

5.2.7.2 Environmental Consequences

Construction

Construction and/or improvement of access roads on non-federal property would be required to reach the east ranges in this alternative. Recreational resources would be directly affected primarily through possible short-term vehicle delays in reaching recreational sites, caused by earth-moving and construction vehicles. Although staged construction equipment would not obstruct access, or the use of, recreational resources, inconvenience to resource seekers (e.g., potential detours to be made, longer wait, and other similar inconveniences) would result. However, the impacts from this construction process would be short-term in nature, recreational opportunities would not be substantially reduced, and recreational resources would not experience direct physical deterioration as a result of implementing Alternative 2. Therefore, short-term less than significant impacts to recreational resources would be anticipated.

Operation

Portions of SDZs are proposed outside NAVMAG property and to the east. These parcels would need to be acquired and would become federally owned property. Therefore, access to the public would be limited. In addition to access restrictions, there are potential indirect impacts from firing range noise, which could lessen visitor enjoyment of publicly accessible recreational resources in the area of the LFTRC. Long-term direct impacts from limitations on public access and noise from firing ranges could result in significant impacts to recreation sites. However, direct and indirect long-term impacts would be less than significant for the following reasons:

- The 2010 Final EIS states that the impacts are less than significant at the NAVMAG site. Even though the current East/West and L-Shaped NAVMAG LFTRC alternatives extend eastward from NAVMAG and would require land acquisition, there are no identified recreational resources in those areas that would be directly or indirectly affected by land acquisition.
- The construction of the access road for the East/West and L-Shaped NAVMAG LFTRC alternatives would make access to the area easier for the public during those times the ranges are not in operation.
- Known recreational resources in the area (primarily Talofofo Falls) would not be impacted by noise during training.

5.2.8 Terrestrial Biological Resources

5.2.8.1 Affected Environment

Vegetation Communities

Figure 5.2.8-1 depicts the vegetation communities within non-federal lands and the southern NAVMAG associated with the proposed Alternative 2. The vegetation communities were mapped based on the following sources:

- USFS (2006) - island-wide coarse-scale mapping used as the starting point.
- Field surveys conducted in 2012 (NAVFAC Pacific 2013a) in notional range areas for more fine-scale mapping.

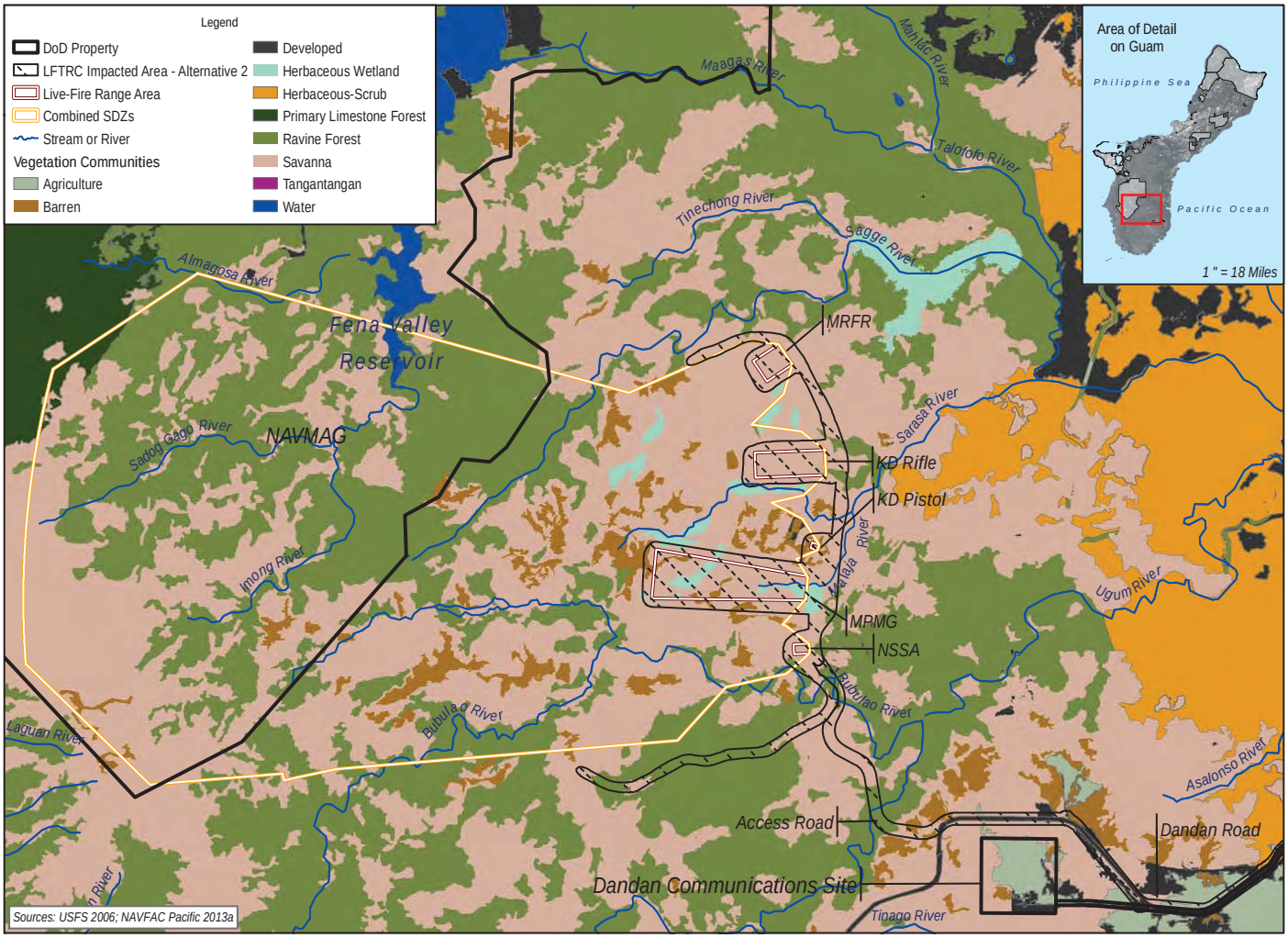


Figure 5.2.8-1
Vegetation Communities -
NAVMAG (East/West) LFTRC Alternative

Vegetation types are described in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.1.1: Vegetation Communities, pages 10-1 to 10-77). The impacted areas (i.e., physical disturbance for range footprints) of Alternative 2 are located on non-federal lands and consist primarily of savanna vegetation interspersed with wetland vegetation associated with streams and drainages. Some barren areas (badlands) are also present. The area within the NAVMAG is associated with the SDZs of the proposed ranges and traverses savanna and patches of ravine forest (see Figure 5.2.8-1). The proposed access road from Highway 4 initially follows, for approximately 2.5 miles (4.0 km), a new 2-lane paved road (Dandan Road) that leads to the new Guam landfill. It then goes north and is routed through an area with no roads or trails and then joins an existing 4-wheel drive trail near the proposed Non-standard Small Arms Range. Vegetation communities along this proposed access road are shown on Figure 5.2.8-1.

Terrestrial Conservation Areas

The SDZs of the proposed ranges overlie established Overlay Refuge lands within NAVMAG and the northern portion of the GovGuam Bolanos Conservation Area (Figure 5.2.8-2). The conservation area was created to protect native flora and fauna in the interior of southern Guam and to support restoration efforts proposed in the Guam Comprehensive Wildlife Conservation Strategy (GDAWR 2006). It is managed by GDAWR for hunting and outdoor recreation. Historically, the area was predominantly ravine forest with very little savanna complex. However, humans and ungulates have changed the landscape through agricultural burning and browsing, and currently the Bolanos Conservation Area is nearly an even mix of savanna complex and ravine forest (GDAWR 2006; Natural Resources Conservation Service 2009).

Wildlife - Native Species

The only native migratory bird species observed during project-specific surveys within the proposed range areas on non-federal lands was the yellow bittern. General information on migratory birds for southern Guam that would be applicable for the area of proposed ranges associated with Alternative 2 is provided in the National Audubon Society's Christmas Bird Counts for southern Guam (National Audubon Society 2013). From 2005 through 2011, a total of 37 species of native birds were reported and all are protected under the MBTA. Some of these species potentially occur within the action area, but most are found primarily in coastal areas. Species likely to use the action area are Pacific golden plover, tattlers, egrets, and yellow bittern. Surveys conducted in 2008-2010 and in 2013 on NAVMAG detected the following native species: Pacific golden-plover, white tern, yellow bittern, and gray-tailed tattler (NAVFAC Pacific 2010, 2013a, 2013b; JRM 2013).

The only native reptile species detected within the range footprints and associated buffer areas during surveys conducted for this SEIS was the Pacific blue-tailed skink (NAVFAC Pacific 2013a, 2013b).

The proposed Dandan access road to the proposed ranges on non-federal lands under Alternative 2 crosses the Bubulao River (Figure 5.2.8-1). Guam's freshwater ecosystems have not been studied in detail and specific data is not available for the aquatic resources in streams that would be crossed or that are in the vicinity of the proposed ranges. Some information is available for southern Guam streams, such as the Talofofo Watershed, as noted in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.5.3: Naval Munitions Site - Freshwater Invertebrates and Fish, pages 10-77 to 10-78). This information is assumed to be generally applicable to other freshwater streams in southern Guam. All Guam indigenous freshwater fish are amphidromous (i.e., fish which move between fresh and salt water during some part of life cycle, but not for breeding). Aquatic fish and invertebrates observed in previous studies are listed in Table 5.2.8-1. Of those recorded, the flagtail, *Stiphodon* goby, and several species of invertebrates are designated as Guam SOGCN (GDAWR 2006).

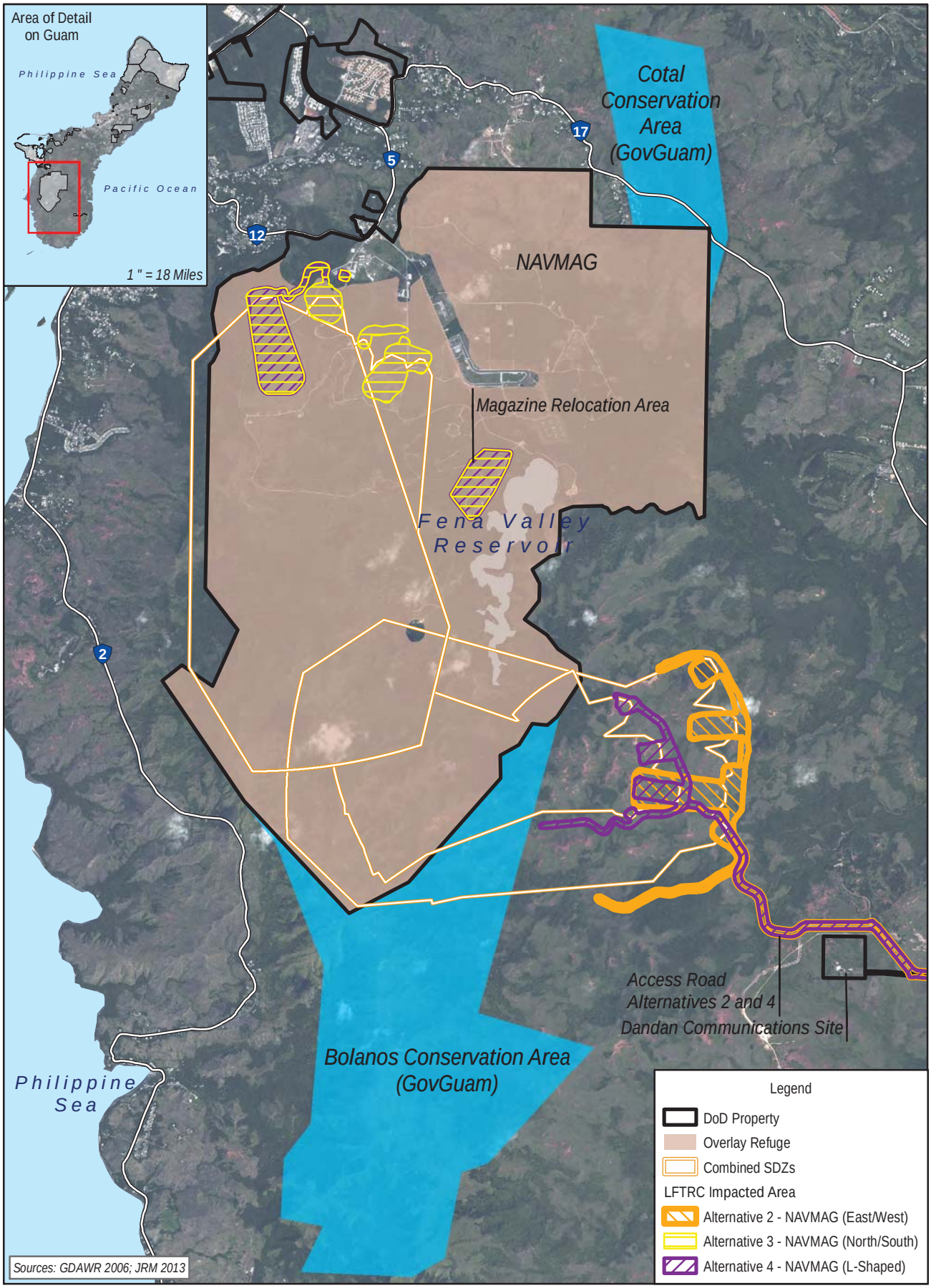


Figure 5.2.8-2
Terrestrial Conservation Areas on the NAVMAG and Adjacent GovGuam Lands

Table 5.2.8-1. Native and Non-native Aquatic Species in the Talofofo Watershed below Fena Dam

Species Group	*Talofofo River*[1]	*Lost/Maagas River*[2]
Native Fish		
Moray eel	✓	
Guam goby		✓
Flagtail*	✓	✓
Yellow tail rock-climbing goby	✓	✓
Stiphodon spp. (goby)*	✓	✓
Non-Native Fish		
Peacock bass		✓
Walking catfish		✓
Bighead catfish		✓
Mosquito fish		✓
Snappers		✓
Tilapia		✓
Native Invertebrates		
Freshwater prawn*		✓
Neritina pulligera (nerite snail)*		✓
Stenomelania plicaria (thiarid snail)*		✓
Atyoida sp. and *Caridina* sp. (shrimp)*		✓
Varunid crabs*		✓
Mangrove crab	✓	

Legend: *Guam SOGCN.
Sources: [1]Best and Davidson 1981; [2]GDAWR 2000; NAVFAC Pacific 2010.

Non-native bird species observed during recent surveys within the proposed range areas of Alternative 2 include the island collared dove, black francolin, and king quail (NAVFAC Pacific 2013a, 2013b).

Feral pigs and Philippine deer are common in ravine and savanna plant communities. Although pig rooting was observed in some perimeter areas of wetlands, habitat degradation in the open lands throughout the Alternative 2 action area is less than in forested areas (NAVFAC Pacific 2013a, 2013b).

The following non-native reptile and amphibian species were observed during surveys conducted for this SEIS within proposed range footprints and associated 328-foot (100-m) buffers: curious skink, marine toad, crab-eating frog, Hong Kong whipping frog, and Gunther's Amoy frog (NAVFAC Pacific 2013a). In addition, brown treesnake are present in forested areas of the Alternative 2 action area.

Based on data from other streams in southern Guam, a variety of non-native fish species may potentially occur in streams within the Alternative 2 action area, particularly Bubulao River (GDAWR 2000; NAVFAC Pacific 2010) (see Table 5.2.8-1).

Special-Status Species: Federal ESA-Listed and Proposed Species

Two ESA-listed species (Mariana fruit bat and Mariana swiftlet) occur within the proposed Alternative 2 action area, including the proposed access road (Table 5.2.8-2 and Figure 5.2.8-3). Although "suitable habitat" for special-status species is present within the Alternative 2 project areas, the brown treesnake, the primary factor in the extirpation of special-status wildlife species on Guam and one of the largest obstacles to achieving recovery of special-status species, is still considered abundant and widespread on Guam. Until brown treesnakes are suppressed or removed from at least targeted areas on Guam, the habitat is not in a suitable condition to support the survival of special-status species due to current snake abundance on Guam (e.g., Guam Micronesian kingfisher, Guam rail, Mariana crow) (USFWS 2010a).

In addition to the discussion below, information for individual species occurring within NAVMAG is provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.5.3: Naval Munitions Site - ESA and Candidate Species, pages 10-79 to 10-84).

Table 5.2.8-2. Distribution of Special-Status Species on Southern NAVMAG and Non-Federal Lands

Name	*Status**		*Habitat*	*Known to Occur*	*Comments*
	ESA	*Guam*			
Mammals					
Mariana fruit bat[b, c, d, e, h, i, k, m, q, r]	T	E	Limestone forest, ravine forest, coastal forest, and coconut plantations.	Yes	Not observed in 2012 surveys; closest occurrence is 3 miles (4.8 km) northwest in NAVMAG; recovery habitat present.
Birds					
Mariana common moorhen[c, d, f, h, m, q]	E	E	Freshwater wetlands.	No	Closest occurrence is Fena Reservoir, 1.5 miles (2.4 km) northwest.
Mariana swiftlet[c, d, h, i, m, q]	E	E	Nests in caves; feeds over savannah and ravine forest.	Yes	Observed during 2012 surveys in the proposed range area.
Mariana crow[a, d, h, m, q, r]	E	E	All forests with a preference for native limestone forest.	No	Extirpated from Guam - last seen in southern Guam in the mid-1960s; recovery habitat present.
Guam Micronesian kingfisher[a, d, h, j, m, q, r]	E	E	Forest and scrub with a preference for native limestone forest.	No	Extirpated from the wild on Guam by 1985; last seen in southern Guam in the 1970s; recovery habitat present.
Guam rail[a, d, l, n, p, q, r]	E	E	Secondary habitats, some use of savanna and limestone forests.	No	Extirpated from the wild on Guam by 1988; last seen in southern Guam in the 1970s; recovery habitat present.
Reptiles					
Pacific slender-toed gecko[c, d, h]	-	E	Forest edge.	No	NR; not observed in 2012 surveys in the impacted areas.
Moth skink[c, d, h, i]	-	E	Forest areas with large tree trunks.		
Slevin's skink[i, s]	PE	E	Mid-elevation closed humid and montane forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Invertebrates					
Guam tree snail[c, d, g, h, i, s]	PE	E	Cool shaded forested areas with high humidity.	No	NR; not observed during 2012 surveys of the impacted areas.
Humped tree snail[c, d, g, h, i, s]	PE	E			
Fragile tree snail[c, d, g, h, i, o, s]	PE	E			
Mariana eight-spot butterfly[i, n, s]	PE	-	Intact limestone forest with host plants.	No	NR; host plants not observed during 2012 surveys of the impacted areas.

Table 5.2.8-2. Distribution of Special-Status Species on Southern NAVMAG and Non-Federal Lands

Name	*Status**		*Habitat*	*Known to Occur*	*Comments*
	ESA	*Guam*			
Mariana wandering butterfly[i, s]	PE	-	Larvae feed on one known host plant species found in native limestone forest habitat.	No	Has not been seen on Guam since 1979 and considered extirpated; host plants not observed during 2012 surveys of the impacted areas.
Plants					
Serianthes tree[d, h, i, m, q, r]	E	E	Limestone and ravine forests.	No	NR; not observed in 2012 surveys in the impacted areas; recovery habitat present.
Cyathea lunulata[d, h, i, q]	-	E	Wet ravines at the boundary with savanna in southern Guam.	No	NR; not observed in 2012 surveys in the impacted areas.
Heritiera tree[i, s]	PE	E	Limestone cliffs and plateaus.	No	NR; not observed in 2012 surveys in the impacted areas.
Tabernaemontana rotensis[i, s]	PT	SOGCN	Limestone forest.	No	NR; not observed in 2012 surveys in the impacted areas.
Cycas micronesica[i, s]	PT	SOGCN	Limestone forest, ravine forest, and savanna summits.	No	NR; not observed in 2012 surveys in the impacted areas.
Bulbophyllum guamense[i, s]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Dendrobium guamense[i, s]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Eugenia bryanii[i, s]	PE	-	Windy exposed coastal clifflines in lowland/ limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Maesa walkeri[i, s]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Nervilia jacksoniae[i, s]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Psychotria malaspinae[i, s]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Solanum guamense[i, s]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Tinospora homosepala[i, s]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.

Table 5.2.8-2. Distribution of Special-Status Species on Southern NAVMAG and Non-Federal Lands

Name	*Status**		*Habitat*	*Known to Occur*	*Comments*
	ESA	*Guam*			
Tuberolabium guamense[i, s, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas; observed on the NAVMAG during surveys for 2010 EIS but outside the current proposed impacted areas.
Hedyotis megalantha[i, s]	PE	-	Savanna	No	NR; not observed in 2012 surveys in the impacted areas.
Phyllanthus saffordii[i, s]	PE	-	Savanna	No	NR; not observed in 2012 surveys in the impacted areas.

Legend: *E = endangered, NR = not reported, PE = proposed endangered, PT = proposed threatened, T = threatened.
Sources: [a]Jenkins 1983; [b]USFWS 1990; [c]COMNAV Marianas 2001; [d]GDAWR 2006; [e]Brooke 2008; [f]Brooke and Grimm 2008; [g]Smith *et al.* 2008; [h]GovGuam 2009; [i]NAVFAC Pacific 2013a, 2013b; [j]USFWS 2008b; [k]USFWS 2009a; [l]USFWS 2009b; [m]USFWS 2011; [n]USFWS 2012a; [o]USFWS 2012c; [p]BirdLife International 2013; [q]JRM 2013; [r]USFWS 2010b; [s]USFWS 2014a, 2014b; [t]NAVFAC Pacific 2010.

MARIANA FRUIT BAT. After 1996, an estimated 5-20 individual Mariana fruit bats were thought to occur within the NAVMAG/Upper Talofofo Watershed, and were assumed to be full time residents of the area, rather than migrants from the main Pati Point Colony on AAFB in northern Guam (Morton and Wiles 2002). USFWS (1996) speculated that disturbance associated with illegal hunting may have inhibited the establishment of a communal roost within the NAVMAG. Although fruit bat recovery habitat occurs within the Alternative 2 action area, surveys within and in the vicinity of the proposed ranges on non-federal lands in 2012 did not observe any Mariana fruit bats (NAVFAC Pacific 2013a). The closest known observations of fruit bats are 3 miles (4.8 km) northwest of the proposed ranges within the NAVMAG (Figure 5.2.8-3). These observations are from surveys conducted in 2013 for this SEIS. Fruit bats are known to travel 6-7.5 miles (10-12 km) to reach forage areas (USFWS 1990), and the Alternative 2 action area contains fruit bat recovery habitat, particularly ravine forest primarily within the SDZ to the west of the range areas within the NAVMAG and to the south of the range areas (see Figure 3.8.3-1). Therefore, there is the potential for the fruit bats within the NAVMAG to occur within the Alternative 2 action area.

MARIANA COMMON MOORHEN. The moorhen is a freshwater obligate species and inhabits emergent vegetation in freshwater marshes and ponds. As described in the 2010 Final EIS, the largest moorhen population was historically at Fena Reservoir. However, conditions in the reservoir have changed, causing moorhens to find more suitable habitat elsewhere. The decrease in suitable habitat seems to be a result of the decline of *Hydrilla verticillata*, a water plant used by moorhens as a nesting substrate (JRM 2013). The current population on Guam is estimated at 100-150 birds (USFWS 2012b).

Although freshwater wetlands were common in the proposed non-federal lands range area, open water habitat was not observed in the impacted area during 2012 surveys. Stinson *et al.* (1991) observed four moorhens on a seasonal pond approximately 300 feet (90 m) north of the proposed MPMG Range boundary (Figure 5.2.8-3). During surveys in June 2012, this area was observed to be a dry, well-vegetated, elongated basin several hundred feet long. In addition, another dry, well-vegetated basin approximately 500 feet (150 m) west of the proposed MPMG Range impacted boundary was also observed. This basin is the headwater of the Sarasa River according to USGS hydrography data.

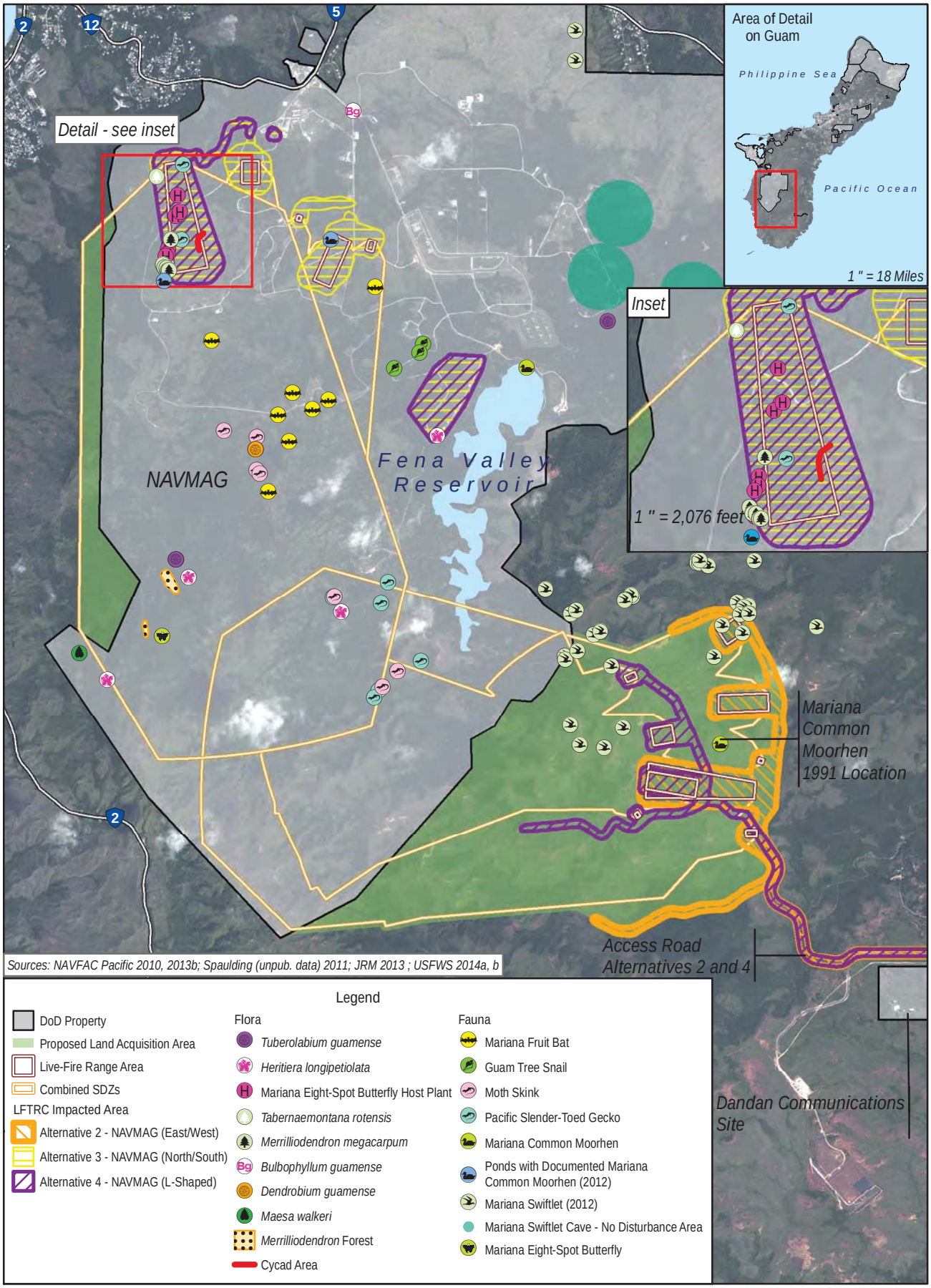


Figure 5.2.8-3
Special-Status Species Observations -
All NAVMAG LFTRC Alternatives

MARIANA SWIFTLET. Swiftlets nest and roost in caves and leave the caves during the day to forage over a wide variety of terrain and vegetation, favoring ridge crests and open grassy areas where they capture small insects while flying (USFWS 1991). There are only three known nesting/roosting caves (Mahlac, Fachi, and Maemong) on Guam for this species and they are located in the northern NAVMAG approximately 2 miles (3.2 km) north of the non-federal lands range area (see Figure 5.2.8-3). The number of swiftlets at Mahlac cave fluctuates around 1,000, while the number at Maemong cave from 2010 to 2012 ranged between 40 and 126, and at Fachi cave have fluctuated between a low of 3 (2011) and a high of 172 (2009) (Brindock 2012).

During June and July 2012, surveys within the proposed non-federal lands range area observed 1-11 Mariana swiftlets at multiple locations from 4 survey stations (see Figure 5.2.8-3) (NAVFAC Pacific 2013a). All Mariana swiftlet observations were between 1.5 and 2.3 miles (2.4-3.7 km) from the three known nesting/roosting caves in the northeastern portion of NAVMAG.

MARIANA CROW. The Mariana crow was last observed in southern Guam in the mid-1960s (USFWS 2005). Since 2009, the population on Guam consisted only of two males on AAFB, occurring primarily within the MSA (USFWS 2009c). However, as of 2012, the Mariana crow is considered extirpated in the wild on Guam (Personal communication via letter from USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, HI regarding the DON NOI for Proposed Placement of LFTRC on Guam NWR; December 7, 2012). The closest population of crows is on the island of Rota, approximately 56 miles (90 km) north of Guam. Crows in northern Guam used primary limestone forest for nesting, with nests exclusively in native trees. They have been observed foraging in both primary and secondary limestone forests and tangantangan (USFWS 2005). Crow recovery habitat is found within proposed project impacted areas and SDZs associated with Alternative 2 (see Figure 3.8.3-1).

GUAM RAIL. The Guam rail was last seen in southern Guam in the 1970s, and was extirpated in the wild by 1985. It exists primarily in captivity on Guam and in mainland zoos. Experimental populations of Guam rails were introduced onto Rota, CNMI in 1989 and onto Cocos Island, off the southern coast of Guam, in 2011 (USFWS 2009b; BirdLife International 2013). The Guam rail prefers edge habitats, especially grassy or secondary vegetation areas which provide good cover; mature forest is deemed only marginal for the Guam rail (USFWS 2009b). Rail recovery habitat is found within proposed project impacted areas associated with Alternative 2 (see Figure 3.8.3-2).

GUAM MICRONESIAN KINGFISHER. The Guam Micronesian kingfisher was last seen in southern Guam in the 1970s, and was extirpated in the wild by 1988. It is now found only in captivity on Guam and at mainland zoos (USFWS 2008). Kingfishers utilized a wide variety of habitats including primary and secondary limestone forest, strand forest, coconut forest, edge habitats, and forest openings, but mature forests with tree cavities suitable for nesting may be an important requirement for kingfisher reproduction (USFWS 2008). Kingfisher recovery habitat is found within proposed project impacted areas and SDZs associated with Alternative 2 (see Figure 3.8.3-1).

SLEVIN'S SKINK. Originally found on Guam, Cocos Island, Rota, Tinian, Guguan, Alamagan, Asuncion, and Maug, it is now limited to Cocos Island, Sarigan, Guguan, Alamagan, Pagan, and Asuncion. Slevin's skink has not been recorded on Guam since 1945 and is believed to be extirpated from Guam; it is now known to occur only on Cocos Island (an atoll south of Guam) (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 2. Therefore, as Slevin's skink is not found within the impacted areas of Alternative 2, this species is not addressed further.

TREE SNAILS. The three proposed endangered tree snail species (Guam tree snail, humped tree snail, and fragile tree snail) were not observed during field surveys conducted within the proposed range footprints on non-federal lands in 2012 in support of this SEIS (NAVFAC Pacific 2013a, 2013b). Although suitable tree snail habitat occurs within the SDZs, the SDZ areas would not be subject to any ground-disturbing activities and proposed range construction and operations would not impact tree snails. Therefore, as the tree snail species are not found within the impacted areas of Alternative 2, these species are not addressed further.

SERIANTHES TREE. The endangered *Serianthes* tree was not observed during field surveys conducted within the proposed range footprints on non-federal lands in 2012 in support of this SEIS (NAVFAC Pacific 2013a, 2013b). The only known location on Guam of the *Serianthes* tree is on AAFB, more than 20 miles (32 km) north of the NAVMAG. However, *Serianthes* recovery habitat is found within proposed project impacted areas and SDZs associated with Alternative 2 (see Figure 3.8.3-2).

HERITIERA LONGIPETIOLATA. This endemic tree is found in crevices of rough limestone in primary limestone forest. Although there are two records of the species on the NAVMAG (see Figure 5.2.8-3), it was not observed during surveys in support of this SEIS and there are no records of the species within the impacted areas of Alternative 2, nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *H. longipetiolata* is not found within the impacted areas of Alternative 2, this species is not addressed further.

TABERNAEMONTANA ROTENSIS. There are no records of *T. rotensis* within the NAVMAG (USFWS 2014) and the species was not observed during surveys in support of the 2010 Final EIS and during 2012 in support of this SEIS nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *T. rotensis* is not found within the impacted areas of Alternative 2, this species is not addressed further.

CYCAS MICRONESICA. The cycad is found in limestone forests throughout Guam and is proposed as an endangered species under the ESA because of the Asian cycad scale insect that is devastating the species. This species has not been observed within the NAVMAG or non-federal lands associated with Alternative 2, nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *C. micronesica* is not found within the impacted areas of Alternative 2, this species is not addressed further.

BULBOPHYLLUM GUAMENSE. An epiphyte in the orchid family, this species occurs in mat-like formations on tree branches of coastal lowland/limestone forests. Currently there are 8 known occurrences on Guam, totaling fewer than 250 individuals (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative 2, nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *B. guamense* is not found within the impacted areas of Alternative 2, this species is not addressed further.

DENDROBIUM GUAMENSE. An epiphyte in the orchid family, this species occurs on tree branches of coastal lowland/limestone forests. Currently, there are 4 known occurrences on Guam with fewer than 250 individuals (USFWS 2014a, 2014b). There is one known occurrence within the NAVMAG within the vicinity of Almagosa Springs (Figure 5.2.8-3). There are no records of the species within the impacted areas of Alternative 2, nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b).

Therefore, as *D. guamense* is not found within the impacted areas of Alternative 2, this species is not addressed further.

EUGENIA BRYANII. A perennial shrub in the myrtle family, the species is known only from the island of Guam. Historically, *E. bryanii* is known from windy exposed coastal clifflines and along the Pigua River, in lowland/limestone forests. Currently, *E. bryanii* is known from 6 occurrences totaling fewer than 420 individuals (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative 2, nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *E. bryanii* is not found within the impacted areas of Alternative 2, this species is not addressed further.

MAESA WALKERI. A shrub or small tree in the primrose family typically found in limestone forests, this species is known from only two individuals on Guam, one of which is located along the southwestern border of the NAVMAG (Figure 5.2.8-3) (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative 2, nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *M. walkeri* is not found within the impacted areas of Alternative 2, this species is not addressed further.

NERVILIA JACKSONIAE. A small herb in the orchid family, this species is found in lowland/limestone forests. On Guam, *N. jacksoniae* is known from 2 occurrences totaling fewer than 200 individuals (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 2, nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *N. jacksoniae* is not found within the impacted areas of Alternative 2, this species is not addressed further.

PSYCHOTRIA MALASPINAE. A shrub or small tree in the coffee family, this species is found in lowland/limestone forests. Currently, *P. malaspinae* is known from five occurrences. None of these individuals have been observed within the last 5 years (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative 2, nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *P. malaspinae* is not found within the impacted areas of Alternative 2, this species is not addressed further.

SOLANUM GUAMENSE. A small shrub in the nightshade family that occurs within limestone forests. Currently, *S. guamense* is known from a single occurrence of one individual on Guam (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 2, nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *S. guamense* is not found within the impacted areas of Alternative 2, this species is not addressed further.

TINOSPORA HOMOSEPALA. A vine in the moonseed family found in limestone forests. Currently, *T. homosepala* is known from 3 occurrences totaling approximately 300 individuals (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 2, nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *T. homosepala* is not found within the impacted areas of Alternative 2, this species is not addressed further.

TUBEROLABIUM GUAMENSE. An epiphyte in the orchid family found in limestone forests. Currently, ***T. guamense*** is known from three occurrences on Guam: one occurrence in the forest ecosystem of the Mt. Almagosa cliffline, one occurrence south of the swiftlet caves on the NAVMAG, and one in the northeastern area of Finegayan (see Figure 5.2.8-3) (NAVFAC Pacific 2010; USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative 2, nor is there suitable habitat within the impacted areas; suitable habitat only occurs within the SDZs of the proposed ranges (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as ***T. guamense*** is not found within the impacted areas of Alternative 2, this species is not addressed further.

HEDYOTIS MEGALANTHA. A perennial herb in the coffee family, this species occurs in savanna areas in southern Guam. Currently, ***H. megalantha*** is known from one large scattered occurrence totaling fewer than 1,000 individuals on southern Guam, between Mt. Alutom and Tarzan Falls. This species typically occurs as lone individuals rather than in patches or groups (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 2 (USFWS 2014b). Therefore, as ***H. megalantha*** is not found within the impacted areas of Alternative 2, this species is not addressed further.

PHYLLANTHUS SAFFORDII. This woody shrub is currently known from four scattered occurrences on southern Guam within savanna areas: Mt. Alutom, Piti Hills, Nimitz Hill "War in the Pacific Lookout," and near the Cetti Bay Watershed (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 2 (USFWS 2014b). Therefore, as ***P. saffordii*** is not found within the impacted areas of Alternative 2, this species is not addressed further.

Special-Status Species: Guam-Listed Species and SOGCN

Three Guam-listed species (Pacific slender-toed gecko, moth skink, and the tree fern *Cyathea lunulata*) were not observed during field surveys conducted within the proposed impacted areas on non-federal lands in 2012 in support of this SEIS, nor is there suitable habitat within the impacted areas (NAVFAC Pacific 2013a, 2013b). Suitable habitat only occurs within the SDZs of the proposed ranges. The SDZs would not be subject to any ground-disturbing activities and proposed range operations would not impact the Pacific slender-toed gecko, moth skink, and the tree fern *Cyathea lunulata*. Therefore, as the Pacific slender-toed gecko, moth skink, and the tree fern *Cyathea lunulata* are not found within the impacted areas of Alternative 2, these species are not addressed further.

5.2.8.2 Environmental Consequences

Construction

Vegetation. The majority (62%) of the impacted areas for the proposed ranges and access road on non-federal lands under Alternative 2 is dominated by savanna (250 acres [101 ha]), with an additional 58 acres (24 ha) of secondary limestone forest and ravine forest, 18 acres (7 ha) of herbaceous wetland, and 68 acres (27 ha) of developed/agriculture/barren areas (Table 5.2.8-3 and see Figure 5.2.8-1).

Table 5.2.8-3. Direct Construction-Related Impacts to Vegetation Communities with Implementation of LFTRC Alternative 2

Project Component	*Vegetation Community (acres [ha])*								
	SLF	***RF***	***HW***	***HS***	***Sav***	***Dev***	***Ag***	***Bar***	***Total***
Range Areas, Associated Features, and Dandan Access Road	0	39.2 (15.9)	17.8 (7.2)	7.5 (3.0)	249.5 (101.0)	45.6 (18.5)	7.2 (2.9)	14.8 (6.0)	**381.6 (154.4)**
HG Range (at Andersen South)	19.4 (7.9)	0	0	1.8 (0.7)	0	1.8 (0.7)	0	0	**23.0 (9.3)**
Total	**19.4 (7.9)**	**39.2 (15.9)**	**17.8 (7.2)**	**9.3 (3.7)**	**249.5 (101.0)**	**47.4 (19.2)**	**7.2 (2.9)**	**14.8 (6.0)**	**404.6 (163.7)**

Legend: SLF = secondary limestone forest; RF = ravine forest; HW = herbaceous wetland; HS = herbaceous scrub; Sav = savannah; Dev = developed; Ag = agriculture; Bar = barren.

The area that would be directly impacted from construction of the proposed ranges on non-federal lands under Alternative 2 is composed of vegetation communities that are common across Guam (Guam Department of Agriculture 2010; USFS 2006). Based on surveys conducted in 2012 in the proposed range areas, the ravine forest community is significantly degraded in many areas by invasion of non-native woody plant species including *Vitex* and betelnut palm, and heavy infestation by herbaceous non-native invasive plants (NAVFAC Pacific 2013a). Impacts to vegetation from construction of the proposed HG Range at Andersen South were discussed in Section 5.1.8.2 and were found to be less than significant. Therefore, there would be less than significant impacts to vegetation with implementation of the construction activities under Alternative 2.

However, the following BMPs may be implemented to avoid and reduce potential direct, long-term impacts of proposed construction activities on vegetation communities with implementation of LFTRC Alternative 2.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the contractor education program.
- *Onsite Vegetation Waste Management Procedures*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the vegetation waste management procedures.
- *DON Guam Landscaping Guidelines*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of landscaping guidelines.
- *LFTRC Range Berm Controls*. To manage stormwater runoff and control erosion, LFTRC range berms would contain native or non-invasive herbaceous vegetation and other engineering controls.
- *Contractor Plans and Specifications*. All construction would occur within the limits of construction shown in the project figures.

Terrestrial Conservation Areas. Only the SDZs associated with the proposed ranges would overlie a portion of Overlay Refuge lands and the Bolanos Conservation Area. As the SDZs would not be subject to any ground-disturbing activities associated with proposed range construction, there would be no impacts to Overlay Refuge lands or the Bolanos Conservation Area with implementation of the construction activities under Alternative 2.

Wildlife - Native Species. The loss of 405 acres (164 ha) of common vegetation communities within southern Guam would result in less than significant impacts to regional native wildlife species. Short-term construction noise may temporarily impact suitable habitat for native birds in the vicinity of the construction areas, but they would relocate to other areas of suitable habitat in the vicinity, and could return to the area following construction. Impacts to wildlife from the construction of the HG Range at Andersen South were discussed in Section 5.1.8.2 and would be less than significant. Implementation of Alternative 2 would not have a significant adverse effect on a population of any migratory bird species or other native wildlife species. Non-listed native reptiles are abundant throughout Guam and impacts to vegetation communities under Alternative 2 would result in less than significant impacts to non-listed native reptile populations.

Proposed construction activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. To prevent the inadvertent spread of non-native species on Guam or to other locations off of Guam, the DON will implement standard biosecurity measures (e.g., HACCP, brown treesnake interdiction measures, coconut rhinoceros beetle vegetation management procedures, outreach/education, and monitoring to evaluate effectiveness of HACCP) into construction protocols, procedures, and activities.

The following BMPs would be implemented to avoid and minimize potential direct, long-term impacts of proposed construction activities on native wildlife with implementation of Alternative 2.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of Biosecurity Outreach and Education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Onsite Vegetation Waste Management Procedures*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the vegetation waste management procedures.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

With implementation of these BMPs, including development of HACCP plans and ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species (e.g., coconut rhinoceros beetle), the potential for the introduction of new or spread of existing non-native species on Guam is substantially reduced. Therefore, there would be less than significant impacts to native wildlife species related to the potential introduction and establishment of non-native species with implementation of proposed construction activities associated with Alternative 2.

Special-Status Species: Federal ESA-Listed and Proposed Species

Impacts to special-status species from the construction of the proposed HG Range at Andersen South were discussed in Section 5.1.8.2 and were determined to be less than significant. The following discussion addresses those species that occur within the impacted areas (ranges and access road) on non-federal lands under Alternative 2.

MARIANA FRUIT BAT. Approximately 43 acres (17 ha) of Mariana fruit bat recovery habitat would be removed due to proposed construction activities under Alternative 2. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Field surveys conducted in 2012 on the non-federal lands did not detect any Mariana fruit bats in the vicinity of the proposed firing ranges. This area is almost entirely open land with small, isolated ravine forest areas. The species is currently limited to the few areas on Guam away from human activities and with suitable habitat, primarily on federal lands on the NAVMAG and AAFB (JRM *et al.* 2012a, 2012b; JRM 2013; A. Brooke, NAVFAC Marianas, personal communication). However, illegal hunting, loss and degradation of native forest, predation by the brown treesnake, and the increased extirpation risk owing to the high vulnerability of very small populations continue to limit the potential recovery of the species on Guam (USFWS 2010a; JRM 2013). Based on the equilibrium/carrying capacity of snakes on Guam (Rodda and Savidge 2007), implementation of the proposed action is not expected to increase the likelihood of predation by the brown treesnake on Mariana fruit bats.

Additional potential direct temporary impacts to the Mariana fruit bat from construction activities are based on the distances from those activities that are likely to cause disturbance to this species (e.g., noise, human activity, lighting). The evaluation of fruit bat disturbance is based on the approach used by USFWS in previous ESA section 7 formal consultations and associated BOs (e.g., USFWS 2006, 2010). For the fruit bat these distances are: roosting habitat within 492 feet (150 m) and foraging habitat within 328 feet (100 m) from the activity (Wiles, personal communication 2006 and Janeke, personal communication 2006, respectively, as cited in USFWS 2006).

The loss of 43 acres (17 ha) of fruit bat recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, and it would not substantially reduce the total number of bats that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to the Mariana fruit bat with implementation of proposed construction activities associated with Alternative 2.

The following BMPs may be implemented to avoid and reduce potential direct long-term impacts of proposed construction activities on Mariana fruit bats and recovery habitat with implementation of Alternative 2.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Pre-Construction Surveys*. Surveys would be completed within suitable fruit bat habitat 1 week prior to onset of construction activities following the USFWS-approved JRM protocol. If a fruit bat is present within 492 feet (150 m) of the project site, the work must be postponed until the bat has left the area.
- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all new

roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

MARIANA CROW. The Mariana crow is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the crow is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the crow, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 2, impacts to the crow would be limited to recovery prospects. If crows are reintroduced and exposed to construction activities under Alternative 2, they may be disturbed (DON 2014).

Although the crow no longer occurs on Guam, approximately 43 acres (17 ha) of crow recovery habitat would be removed due to proposed construction activities associated with Alternative 2. This area is included in the impacts to vegetation discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

This loss of crow recovery habitat on Guam would not preclude the recovery or survival of the crow, and it would not substantially reduce the total number of crows that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to the Mariana crow with implementation of proposed construction activities associated with Alternative 2. If and when the crow is reintroduced to Guam, the best available information indicates project-related noise would not further reduce the amount of recovery habitat suitable for this species' breeding, feeding and sheltering (USFWS 2010a).

The following BMPs may be implemented to avoid and reduce potential direct long-term impacts of proposed construction activities on Mariana crow recovery habitat with implementation of Alternative 2.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

GUAM RAIL. The Guam rail is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the rail is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the rail, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the rail is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 2, impacts to the rail would be limited to recovery prospects. If rails are reintroduced and exposed to construction activities under Alternative 2, they may be disturbed (DON 2014).

Although the rail no longer occurs on Guam, approximately 49 acres (20 ha) of rail recovery habitat would be removed due to proposed construction activities under Alternative 2. This area is included in the impacts to vegetation discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

This loss of rail recovery habitat on Guam would not preclude the recovery of the rail, and it would not substantially reduce the total number of rails that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to the rail with implementation of proposed construction activities associated with Alternative 2.

The following BMPs may be implemented to avoid and reduce potential direct and indirect long-term impacts of proposed construction activities on the recovery of the Guam rail with implementation of Alternative 2.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

GUAM MICRONESIAN KINGFISHER. The Guam Micronesian kingfisher is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the kingfisher is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the kingfisher, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the kingfisher is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 2, impacts to the kingfisher would be limited to recovery prospects. If kingfishers are reintroduced and exposed to construction activities under Alternative 2, they may be disturbed (DON 2014).

Although the kingfisher no longer occurs on Guam, approximately 43 acres (17 ha) of kingfisher recovery habitat would be removed due to proposed construction activities associated with Alternative 2. This area is included in the impacts to vegetation discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

This loss of kingfisher recovery habitat on Guam would not preclude the recovery of the kingfisher, and it would not substantially reduce the total number of kingfishers that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to the kingfisher with implementation of proposed construction activities associated with Alternative 2.

The following BMPs may be implemented to avoid and reduce potential direct long-term impacts of proposed construction activities on kingfisher recovery habitat with implementation of Alternative 2.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.

- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

MARIANA SWIFTLET. Based on 2012 field surveys, this species forages in the proposed range area, particularly in the northern portion, closer to the only known swiftlet nesting/roosting caves on Guam. The conversion of 399 acres (162 ha) of vegetation communities commonly found throughout southern Guam (e.g., herbaceous scrub/savanna, ravine forest, and developed/agricultural/barren) to the proposed ranges and access road would not diminish the amount of swiftlet foraging habitat within the area. Swiftlets would continue to forage within the extensive foraging habitat surrounding the proposed range area, including the extensive areas of savanna and ravine forest to the north, west, and east of the proposed range areas, and areas in the vicinity of the nest/roost caves on NAVMAG and the drainages of the Mahlac, Maagas, and Talofofo rivers (see Figures 5.2.8-1 and 5.2.8-3). The proposed construction activities would also not impact regional insect populations that are the prey base for the swiftlet. Although noise levels within the immediate vicinity of proposed construction activities would increase, they would be localized and temporary. Proposed construction activities would not impact the swiftlet nesting/roosting caves approximately 2 miles (3 km) to the north of the proposed ranges. Therefore, there would be less than significant impacts to the Mariana swiftlet with implementation of the proposed range construction activities under Alternative 2.

MARIANA COMMON MOORHEN. Although no suitable open water habitat currently occurs within the area of the proposed ranges under Alternative 2, moorhens were reported from a seasonal pond just to the west of the proposed KD Pistol Range in 1991. During surveys in June 2012, this area was observed to be a dry, well-vegetated basin. Even if sufficient rain fell in future years that would result in ponding of this area, the extensive vegetative growth would preclude the availability of open water and prevent moorhens from using this area. The only other suitable moorhen habitat is located at Fena Valley Reservoir, approximately 1.5 miles (2.4 km) to the northwest of the proposed ranges. However, in accordance with proposed BMPs (see Section 2.8), pre-construction surveys within the proposed construction area for moorhens will be conducted 1 week before construction activities begin to ensure that open water habitat does not occur and moorhens are not within the impacted areas. Therefore, there would be no impacts to the Mariana common moorhen with implementation of the proposed range construction activities under Alternative 2.

SERIANTHES TREE. Although individual *Serianthes* trees do not occur within the impacted areas of Alternative 2, approximately 18 acres (7 ha) of *Serianthes* recovery habitat would be removed due to proposed construction activities. This area is included in the impacts to vegetation discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

This loss of *Serianthes* recovery habitat on Guam would not preclude the recovery of *Serianthes*, and it would not substantially reduce the total number of *Serianthes* that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to *Serianthes* with implementation of proposed construction activities associated with Alternative 2.

The following BMPs may be implemented to avoid and minimize potential direct long-term impacts of proposed construction activities on the recovery of *Serianthes* with implementation of Alternative 2.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Special-Status Species: Guam-Listed and SOGCN

The only Guam-listed species that would occur within the proposed range areas are also listed under the federal ESA and were discussed above.

Operation

Vegetation. With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, 1-year post construction monitoring to evaluate effectiveness of HACCP, and applicable elements of the SIP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of Alternative 2 is considered unlikely.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by increasing erosion, allowing for the establishment of non-native species, and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. Native plants and their habitats on Guam are adapted to a humid, tropical climate and are not adapted to a fire driven ecosystem (USFWS 2008a). Fire is a serious problem on Guam. Fire history records available from 1979 - 2002 indicate that over this 23-year period more than 16,000 fires have occurred in Guam (averaging more than 700 per year) that have burned in excess of 100,000 acres (40,469 ha), primarily in southern Guam. Of these 16,000 fires, 477 of them occurred on Naval Base Guam, primarily at Apra Harbor and NAVMAG, burning more than 9,800 acres (3,966 ha) (Nelson 2008).

As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's Wildland Fire Management Plan (Nelson 2008) (see Section 2.8). It would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions), and location and management of firebreaks, fire-fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). With implementation of the Range Fire Management Plan, which establishes management and fire suppression and emergency response procedures, potential impacts from range-related wildfires would be less than significant. The USFWS concluded in their BO for the 2010 Final EIS that they anticipated that no additional vegetation would be lost due to wildfires igniting as a result of proposed live-fire training operations (USFWS 2010a). Therefore, there would be less than significant impacts to vegetation from operation of LFTRC Alternative 2.

Terrestrial Conservation Areas. While the modeled noise levels from proposed range operations may be heard within the southern portion of NAVMAG on Overlay Refuge lands and within the northern portion of the Bolanos Conservation Area (see Figures 5.2.8-2 and 5.2.8-4), the noise levels would be approximately 55-64 dB ADNL or less and would be barely perceptible above ambient noise levels for the region (see Section 5.2.4, Noise). Signs would be posted along the perimeter of the SDZ notifying the public of an active live-fire range within the area behind the signs and access is restricted during operations. The Bolanos Conservation Area is remote, difficult to access, limited to use by hikers and hunters, and management is minimal (GDAWR 2006). Therefore, proposed operations at the proposed Alternative 2 would result in less than significant impacts to management or conservation values of Overlay Refuge lands or the Bolanos Conservation Area.

Wildlife - Native Species. Based on field surveys in support of this SEIS, the abundance and diversity of native wildlife within the area of the proposed Alternative 2 range area is low, primarily due to the prevalence of the savanna vegetation community. Noise associated with proposed live-fire range operations may impact native wildlife in the vicinity of the ranges. However, noise associated with similar live-fire operations at ranges in Hawaii has not resulted in significant impacts to wildlife in the vicinity of those ranges (Army 2009, 2013a). Implementation of Alternative 2 would not have a significant adverse effect on a population of migratory bird species or other native wildlife species. Impacts to wildlife from the operation of the HG Range at Andersen South were discussed in Section 5.1.8.2 and there would be less than significant impacts.

With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, applicable elements of the SIP, and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the proposed LFTRC under Alternative 2 is considered unlikely. The DON recognizes the USFWS' ongoing concern regarding potential spread of the brown treesnake. The DON will consult with USFWS under ESA section 7 to determine if additional brown treesnake interdiction measures are warranted and applicable. In addition, lighting associated with the range and support areas would be hooded or shielded to the maximum extent practicable to prevent unnecessary light beyond operational areas. Therefore, there would be less than significant impacts to native wildlife with operation of proposed LFTRC Alternative 2.

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. The assessment of noise levels associated with the proposed HG Range at Andersen South was previously discussed in Section 5.1.8.2. There would be no impacts to Mariana fruit bats from noise associated with operation of the HG Range.

For those species of fruit bats that have been tested for hearing sensitivity, their audiograms are very similar to those of humans, with similar upper and lower frequency limits and hearing threshold levels (Calford *et al.* 1995; Heffner *et al.* 2006; Koay *et al.* 1998). Therefore, it is likely that noise from live-fire operations at the proposed ranges would be heard by fruit bats as it would be heard by humans.

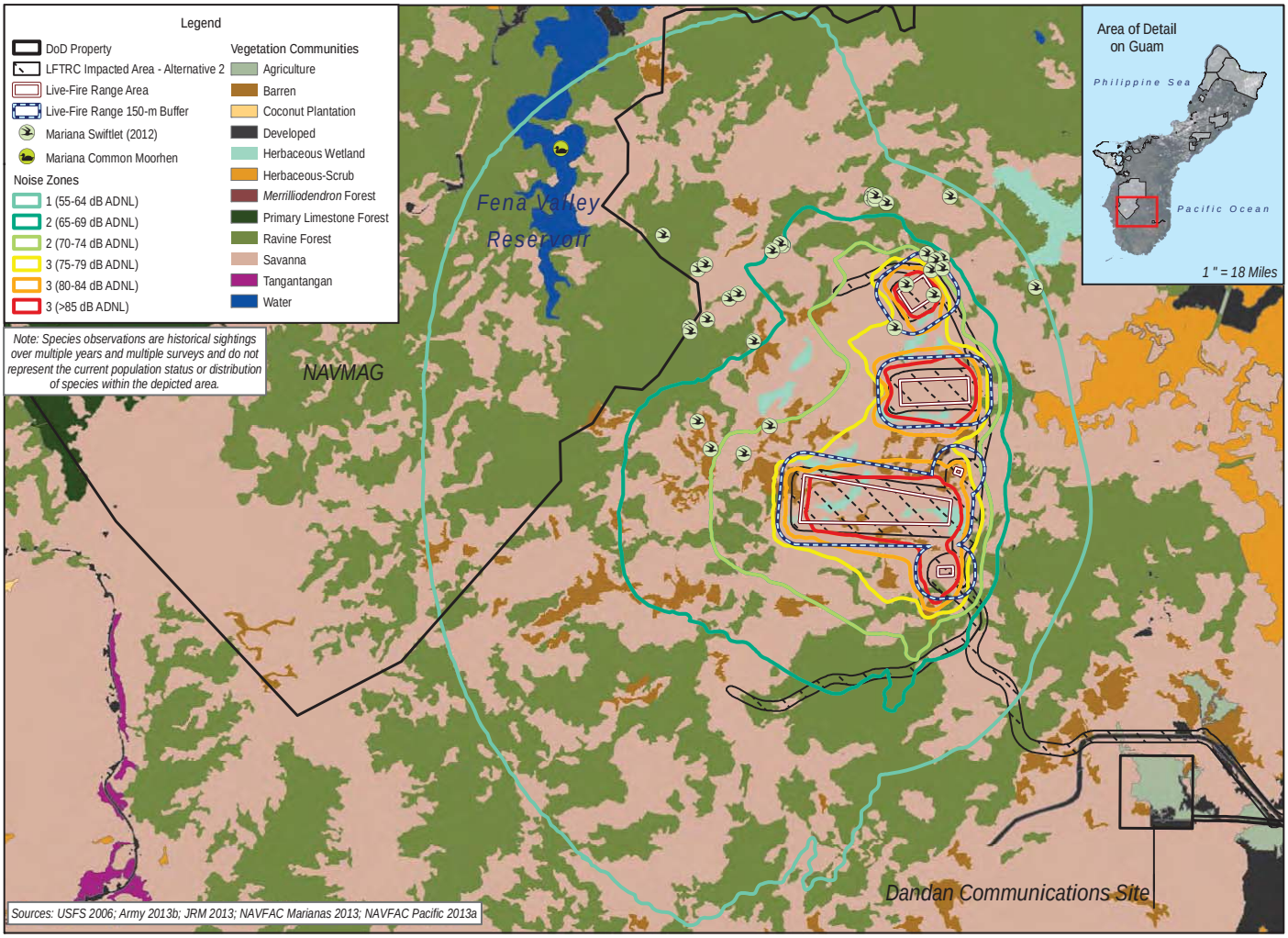


Figure 5.2.8-4
Vegetation Communities and Mariana Swiftlet and Mariana Moorhen Occurrences within Small Arms ADNL Noise Zones - NAVMAG (East/West) LFTRC Alternative

The USFWS established 60 dB and 93 dB as two thresholds of biological significance based on their review of impacts of noise to wildlife. Noise levels above 60 dB have been found to affect acoustic communication, breeding biology, survival of young, and non-auditory bird and mammal physiology. Noise levels above 93 dB may temporarily or permanently affect hearing (USFWS 2010a). No species would be exposed to noise levels of 93 dB or greater under the proposed action. While noise levels may approach 93 dB in the immediate vicinity of the firing of an individual weapon, fruit bats or other wildlife species would not be in proximity to the live-fire event given the location and nature of weapons firing within a developed range area.

Responses to noise can vary among individuals as a result of habituation where after a period of exposure to a stimulus, an animal stops responding to the stimulus. In general, a species can often habituate to human-generated noise when the noise is not followed by an adverse impact. Even when a species appears to be habituated to a noise, the noise may produce a metabolic or stress response (increased heart rate results in increased energy expenditure) though the response may or may not lead to changes in overall energy balance. Anthropogenic noise disturbance is known to alter animal behavioral patterns and lead to population declines (Barber *et al.* 2011; Francis and Barber 2013; McGregor *et al.* 2013).

In addition to noise level, the frequency and regularity of the noise also affect species sensitivity. That is, different types of noise sources will produce different effects on different species. Noise from aircraft overflights may not produce the same response from a wildlife species as noise from a land-based noise source such as a vehicle, chainsaw, or gun shot. Wildlife species often do not react only to a noise source but more importantly to the visual component associated with that noise source. Nesting birds will react to a noise source by tilting their head, becoming alert, etc. but often do not leave the nest or perch until there is a visual connection with the noise source. For example, birds may not react to just the sound of a chainsaw, but when that sound is coupled with a human walking near the bird, the bird will flush. This is also shown in reactions by various species to aircraft overflights (airplanes and helicopters). An overflight with just a sound component does not elicit a strong response, but if an animal hears and then sees the aircraft, the bird will more likely flush and move away (Manci *et al.* 1988; USFWS 1992; Krausman *et al.* 1993; Bowles 1995). In other words, human intrusions near roost sites, nests, foraging areas, etc. (e.g., timber harvesting, hiking, hunting) are readily detectable and substantial (USFS 1992).

Species that are commonly hunted often demonstrate behavioral (e.g., flushing, startle response) or physiological responses (e.g., increased heart rates, increased respiration rates) to gunshot sounds (Larkin *et al.* 1996). Knight *et al.* (1987) found that American crows nesting in urban areas were less wary of people than American crows nesting in rural habitat and attributed the difference to the hunting of rural crows. Barron *et al.* (2012) found that American crows avoided areas with live-fire exercises in a similar fashion and suggested that species hunted by humans will be more adversely affected by human activity, including military training (e.g., live-fire training) than species that are not hunted.

As stated by Morton and Wiles (2002), "Poaching is a particularly insidious activity because not only does it impact fruit bats through mortality, it reinforces behavioral avoidance of humans. Consequently, roosting or foraging fruit bats that might not otherwise be disturbed by some human activities … may become unduly sensitized to them because of illegal hunting." Based on observations on Guam and Rota, fruit bats have abandoned areas where hunting has occurred and did not return even though no further hunting or gunshots occurred within the area for months after (Janeke 2006; AAFB 2008b; USFWS 2009a; Mildenstein and Mills 2013). In addition, anecdotal evidence from numerous individuals who have conducted fruit bat research on Guam and the CNMI for many years indicate that fruit bats do avoid areas that have been previously subjected to hunting and also areas that experience live-fire activities (G.

Wiles, Washington Department of Fish and Wildlife, personal communication, 2014; T. Mildenstein, University of Montana, personal communication, 2014; D. Janeke, HDR, Inc., personal communication, 2014; N. Johnson, Marianas Conservation Unlimited, personal communication, 2014). For example, during fruit bat monitoring at AAFB near the CATM range as part of a larger study monitoring the effects of aircraft overflights on fruit bats and crows (JRM *et al.* 2012b), N. Johnson observed flying fruit bats avoid the CATM range by 300-400 m when live-fire operations were being conducted (N. Johnson, Marianas Conservation Unlimited, personal communication, 2014).

However, a species can also habituate to human-generated noise when the noise is not followed by an adverse impact. While fruit bats may avoid an area subjected to hunting and the associated gun shots, fruit bats, like most wildlife species, will also learn that if a disturbance or sound does not produce an adverse effect (e.g., mortality), then they can habituate to that disturbance or sound and will not show an adverse reaction (e.g., flying away, avoiding the area) (Boyle and Samson 1985; Francis and Barber 2013).

Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) may influence reproductive success and confound the ability to identify the ultimate factor in limiting productivity of a certain species, area, or region (Smith *et al.* 1988).

Based on identified recovery habitat for the Mariana fruit bat (USFWS 2010b), noise levels of 60 dB ADNL and greater would overlie 824 acres (333 ha) of recovery habitat in the vicinity of Alternative 2 (Table 5.2.8-4).

Table 5.2.8-4. Noise Levels overlying Mariana Fruit Bat Recovery Habitat (acres [ha]) with Implementation of LFTRC Alternative 2

60-64 dB ADNL	*65-74 dB ADNL*	*75-85+ dB ADNL*	*Total*
554.4 (224.4)	251.8 (101.9)	17.4 (7.0)	**823.6** **(333.3)**

Given the ongoing poaching of fruit bats on Guam, it is likely that those fruit bats that currently occur on Guam will avoid areas of live-fire training as they may have experienced a poaching event. While there is the potential for eventual habituation by fruit bats to LFTRC live-fire activities, fruit bats are expected to initially avoid areas of live-fire training activities. Therefore, fruit bats may temporarily avoid approximately 824 acres (333 ha) of recovery habitat due to proposed live-fire range operations. However, proposed live-fire operations at the LFTRC are not continuous and would occur between 7:00 a.m. and 7:00 p.m. for 39 weeks per year, and night operations (estimated to occur 2 nights per week over 39 weeks per year) would occur between 7:00 p.m. and 10:00 p.m. or 6:00 a.m. and 7:00 a.m. In addition, live-fire operations would not physically impact recovery habitat. This temporary avoidance of recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, and it would not substantially reduce the total number of fruit bats that the island can support.

With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, applicable elements of the SIP, and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of Alternative 2 is considered unlikely. Therefore, there would be less than significant impacts to the Mariana fruit bat with implementation of proposed operational activities associated with Alternative 2.

MARIANA CROW, GUAM RAIL, AND GUAM MICRONESIAN KINGFISHER. These species are extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of these species is reasonably certain to occur and the species are likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of these species, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow, rail, and kingfisher are successfully re-introduced and then have the potential to be exposed to operational activities under Alternative 2, there would be no impact to these species. If the species are reintroduced and exposed to LFTRC operational activities under Alternative 2, they may be disturbed.

MARIANA SWIFTLET. Based on surveys conducted for this SEIS, swiftlets were observed within what would be the proposed 75-79 dB ADNL and less noise contours associated with the proposed ranges under Alternative 2 (see Figure 5.2.8-4). Although the specific hearing ability of the Mariana swiftlet is not known, they are expected to be able to hear as well as most birds, which are sensitive to sounds from 100 hertz to 8-10 kilohertz (Dooling 1980). Therefore, they are able to hear the sounds associated with live-fire ranges. Although foraging swiftlets may avoid areas within the proposed ranges with the highest noise levels (e.g., 79 dB ADNL), the total area within this contour would be approximately 300 acres (121 ha). Swiftlets would continue to forage within the extensive foraging habitat surrounding the proposed range area, including the areas of savanna and ravine forest to the north, west, and east of the proposed range areas, and areas in the vicinity of the nest/roost caves on the NAVMAG and the drainages of the Mahlac, Maagas, and Talofofo rivers (see Figures 5.2.8-1 and 5.2.8-3). The proposed range operations would not impact regional insect populations that are the prey base for the swiftlet. In addition, swiftlets are generally more actively foraging in the early morning and late evenings before and after proposed range operations. As swiftlets do not have a history of being hunted, they would not have the same aversion to gunfire that Mariana fruit bats have and, therefore, may not avoid areas of live-fire range operations. Proposed range operations and associated noise would not impact the swiftlet nesting/roosting caves approximately 2 miles (3.2 km) to the north of the proposed ranges. Therefore, given the limited area (approximately 300 acres [121 ha]) that may be potentially avoided by foraging swiftlets, the extensive remaining foraging habitat within the surrounding areas that would still be available for foraging, and that swiftlets would still forage in the mornings and evenings before and after range operations, there would be less than significant impacts to the Mariana swiftlet due to proposed range operations under Alternative 2.

MARIANA COMMON MOORHEN. The modeled 55 dB ADNL noise contour overlies the southern portion of Fena Valley Reservoir. Moorhens primarily use the northern portion of the reservoir, near the spillway, for nesting, feeding and resting (Brooke and Grimm 2008; Brindock 2012). Given the low modeled noise level that may occur within the southern portion of the reservoir (i.e., 55 dB ADNL is approximately equal to ambient noise levels; see Section 3.4, Noise), and that moorhens predominantly use the northern portion of the reservoir that would be outside the 55-dB contour, there would be less than significant impacts to Mariana common moorhens with implementation of the proposed range operations under Alternative 2.

SERIANTHES TREE. *Serianthes* does not occur within the Alternative 2 action area. Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see *Vegetation* above, and Section 2.8), potential impacts from range-related wildfires on *Serianthes* would be less than significant. Therefore, there would be less than

significant impacts to *Serianthes* or recovery habitat due to proposed range operations under Alternative 2.

Special-Status Species: Guam-Listed and SOGCN

The only Guam-listed species that would occur within the proposed range areas are also listed under the federal ESA and were discussed above.

5.2.9 Marine Biological Resources

5.2.9.1 Affected Environment

The Alternative 2 proposed project area is entirely inland, with no marine in-water or coastal components. Therefore, there is no marine biological resources affected environment for Alternative 2.

5.2.9.2 Environmental Consequences

No in-water construction, dredging, or training activities, and/or land-based construction activities proposed under Alternative 2 would directly or indirectly affect the marine environment. Therefore, no direct or indirect impacts are expected.

Scoping comments for this SEIS noted concern regarding the possibility that contamination could migrate from the ranges through stormwater runoff. However, as discussed in Section 5.2.2, Water Resources, there would be no impacts to nearshore waters through implementation of surface water protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs during construction and implementation of LID features in accordance with the DoD UFC LID (UFC 3-210-10) and Section 438 of the EISA, range maintenance BMPs, and pollution prevention plans during operations).

5.2.10 Cultural Resources

5.2.10.1 Affected Environment

The following discussion summarizes previous cultural resources studies and known historic properties and other cultural resources within the PDIA and PIIA associated with Alternative 2.

The Alternative 2 area, also known as NAVMAG (East/West), is located both within the far southeast portion NAVMAG and just outside the NAVMAG to the east on lands owned by the GovGuam and by private landowners. As early as December 1944, miles of roads and magazines were constructed at the NAVMAG and the area was commissioned on February 22, 1945 (Mason Architects and Weitze Research 2009). During a limited expansion in the Korean conflict of the early 1950s, most of the present main administration buildings and many of the magazines were designed and built as part of the permanent base development program for Guam.

The affected environment for cultural resources associated with Alternative 2 is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 12: Cultural Resources, Section 12.1.5.1: Naval Munitions Site, pages 12-33 to 12-37). This description of the affected environment is updated here with new information from recent archaeological and architectural investigations conducted for this SEIS and other projects. To determine whether site information is from previous investigations (such as the 2010 Final EIS or other cultural resource studies) or prepared during in-fill studies conducted for this SEIS, refer to dates in the reference column in each table for the archaeological sites. Certain information about built properties (such as date and function) was derived from iNFADS.

Portions of the Alternative 2 PDIA and PIIA were surveyed for the presence of cultural resources for the original proposed action (2010 Final EIS). Those and other previous investigations in the area included archaeological surveys (Henry *et al.* 1998; Hunter-Anderson and Moore 2002), a reconnaissance survey (Dye *et al.* 1978), architectural surveys (Mason Architects and Weitze Research 2010; Welch 2010), and TCP studies (Griffin *et al.* 2010). Additional investigations conducted for this SEIS included intensive cultural resource inventories in the PDIA and reconnaissance inventories in PIIA for this SEIS (Dixon *et al.* 2015a, 2015b). Note: due to changes in the alternative as a result of the SEIS planning process, 109.5 acres (44.32 ha) in the PDIA and 65.49 acres (26.5 ha) in the PIIA were added for Alternative 2 after the surveys were conducted. These 175 acres (70.82 ha) were examined through historic materials, aerials, and a comparison with adjacent areas to assess impacts to cultural resources. Collectively, these investigations provide the comprehensive inventory of cultural resources for Alternative 2.

As described in Section 5.1.10.1, the HG Range would be located at Andersen South under all of the LFTRC alternatives. This entire area was previously surveyed at an intensive level (Welch 2010; Dixon *et al.* 2011a).

During October through December 2014, the DON consulted with the parties to the 2011 PA and the public on the Draft TRRA. Consistent with Stipulation V.C of the 2011 PA, the TRRA provided planning level information on potential direct and indirect effects to historic properties within areas that may be selected in the Navy's ROD for the live-fire training range complex. The Draft TRRA included information on the locations, orientations, and designs of each proposed LFTRC location. In addition to receipt of written comments, DON cultural resources professionals conducted three consultation sessions with the parties to the PA to discuss the analysis. The DON will take all comments into account in preparing the Final TRRA, which is planned for publication shortly after this Final SEIS. Comments and considerations developed during the Draft TRRA consultation process have been incorporated in this Final SEIS and informed the Draft RMP, as required by Stipulation V.C.4 of the 2011 PA.

Cultural Resources in the Alternative 2 PDIA

Alternative 2 would involve the construction of individual ranges, support buildings, and an access road. This construction area comprises the PDIA. Table 5.2.10-1 lists ten known archaeological sites located within the Alternative 2 PDIA within the NAVMAG. They include seven artifact scatters and two sites with *latte* components, all of which are eligible for listing in the NRHP, and one small artifact scatter that is not considered eligible for listing in the NRHP. No historic properties have been identified in the PDIA of the proposed HG Range at Andersen South.

Table 5.2.10-1. Archaeological Sites within the Alternative 2 PDIA

GHPI Number[1]	*Temporary Site Number/ Map Number*	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-2628***	T-TA-002	*Latte* set partial[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2631***	T-TA-006	Artifact scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2633***	T-TA-007	Artifact scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2634***	T-TA-008	Artifact scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2635***	T-TA-009	Artifact scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2637***	T-TA-011	Artifact scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2638***	T-TA-013	Artifact scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2639***	T-TA-014	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2689***	T-TA-046	*Latte* set	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2759	T-TA-047	Artifact scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NRHP criterion D = eligible for potential to yield information important in prehistory or history.

Notes: [1] Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

[2] Sites are in both the PDIA and the PIIA.

** Revised to match Guam GHPI forms dated May 28, 2014.

***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated August 22, 2013 [RC2013-0853]).

There are no known buildings or structures located in the PDIA for Alternative 2.

No TCPs have been identified in the PDIA for this alternative.

Cultural Resources in the Alternative 2 PIIA

The PIIA comprises SDZs for the LFTRC and HG ranges and associated areas potentially affected by increases in noise. It includes no locations of potential direct impact due to construction. Table 5.2.10-2 summarizes the 102 known archaeological sites within the Alternative 2 PIIA. Seventy-three sites are eligible for listing in the NRHP, including Pre-Contact artifact scatters, *latte* sites, and rockshelters. Twenty-nine sites, consisting of Pre-Contact artifact scatters and *latte* sites, have not been evaluated for listing in the NRHP. Should this alternative be selected, final assessments would be determined consistent with the procedures in the 2011 PA.

Table 5.2.10-2. Summary of Archaeological Sites Known to be Located within the Alternative 2 PIIA

Site Type	*Period***	*Number of Sites of this Type in the Impact Area*	*NRHP Eligible?*	*NRHP Criteria*
Pre-Contact Artifact Scatters	Pre-Contact/Latte	30	Yes	D
Pre-Contact Artifact Scatters	Pre-Contact/Latte	19	Not Evaluated	NA
Mixed Component Artifact Scatter	Pre-Contact/Latte/ Spanish Missionization/ Chamorro Spanish Wars	1	Yes	D
Mixed Component Artifact Scatter	Pre-Contact/Latte/ Spanish Missionization/ Chamorro Spanish Wars	1	Not Evaluated	NA
Historic Artifact Scatters	First American Territorial	1	Yes	D
Latte Sites	Pre-Contact/Latte/ Spanish Missionization/ Chamorro Spanish Wars (one is a potential TCP)	36	Yes	D
Latte Sites	Pre-Contact/Latte	9	Not Evaluated	NA
Rockshelters	Pre-Contact/Pre-Latte/Latte	2	Yes	D
Cultural Deposits	Pre-Contact/Latte	2	Yes	D
Chiseled Steps	Pre-Contact/Latte	1	Yes	D

Legend: NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion D = eligible for potential to yield information important in prehistory or history.
Note: ** Revised to match Guam GHPI forms dated May 28, 2014.

There are no known buildings or structures within the PIIA for Alternative 2.

A portion of one high density *latte* environ (an area with a high density of archaeological sites containing *latte* stones) that has been identified as a potential TCP is located within the PIIA.

5.2.10.2 Environmental Consequences

Construction

Construction activities associated with Alternative 2 have the potential to adversely affect historic properties and impact culturally important natural resources. Final determinations of effect would follow the procedures in the 2011 PA. Following is a discussion of potential direct and indirect effects to historic properties and impacts to culturally important natural resources.

Construction of the ranges, support facilities, and utilities would primarily occur in the south-central portion of Guam east of the NAVMAG (see Figure 2.5-3). Given the substantial development anticipated in the PDIA, it is assumed for purposes of this analysis that 100% of the area would be disturbed. Nevertheless, design alternatives to avoid and minimize adverse effects would be considered, consistent with procedures in the 2011 PA. No construction would occur in the PIIA.

Excavation and soil removal associated with the construction of Alternative 2 could adversely, directly affect nine known historic properties, including Pre-Contact artifact scatters and sites containing *latte* components (see Table 5.2.10-1). Seven of the historic properties are located within both the PDIA and the PIIA. Direct impacts to these sites would only occur to the portion within the PDIA. There is also a potential for NRHP-eligible archaeological sites in the 109.5 acres (44.32 ha) of unsurveyed areas within

the PDIA. No NRHP-eligible or unevaluated buildings or structures would be adversely affected by construction.

Construction activities associated with Alternative 2 have the potential to directly impact culturally important natural resources. The 2011 PA contains measures for coordinating with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners and traditional artisans regarding identification and disposition of these important resources prior to construction (see 2010 Final EIS, Volume 2: 2-10; Volume 9, Appendix G, Chapter 4).

No historic properties or culturally important natural resources are anticipated in conjunction with utility upgrades that would be associated with Alternative 2. The modification or replacement of existing underground power lines adjacent to Dandan Road and the placement of water and wastewater lines adjacent to power lines would not affect any known cultural resources. There are no NRHP-eligible properties or culturally important natural resources located in the areas planned for water or wastewater utility upgrades or electrical utilities to support Alternative 2.

There are no historic properties located in the PDIA or PIIA for the proposed HG Range at Andersen South. Therefore, no adverse effects to historic properties are anticipated due to construction of the HG Range.

Operation

Operations associated with Alternative 2 could cause indirect adverse effects to historic properties as discussed below. Final determinations of effect would follow the procedures in the 2011 PA. Following is a discussion of potential adverse effects of operations associated with Alternative 2.

The potential for direct effects within the SDZ would be limited to the risk of strikes from stray rounds during Alternative 2 operations. The risk of such effects occurring is extremely low. The range would be designed to contain live fire inside the range itself to minimize the probability of rounds landing in the SDZ. Additionally, if a stray round were to escape the range, the chance of it hitting a historic property is remote, given the size of the SDZ and dispersal of historic properties. For these reasons, the potential for direct adverse effects as a result of range operations is *de minimis*.

Indirect adverse effects to NRHP-eligible archaeological sites from the operation of Alternative 2 could result from changes affecting site integrity. For many types of archaeological sites (i.e., ceramic scatters, rock alignments), auditory impacts associated with live-fire operations would not affect characteristics that qualify them for the NRHP. An increase in noise associated with live-fire operations may adversely affect historic properties for which solitude, quiet, or contemplation contribute to or define their significance, such as TCPs.

Under Alternative 2, small arms live-fire noise would be audible near 1 NRHP-eligible and 21 unevaluated sites that are located within the expanded noise contours (Table 5.2.10-3). Average noise levels during range operations are projected to increase from current levels of approximately 45 dB to between 65 dB and 85 dB ADNL due to the introduction of small arms live-fire noise (see Section 5.2.4, Noise). Eighteen of the unevaluated sites are Pre-Contact artifact or ceramic scatters, while four sites (one NRHP-eligible and three sites unevaluated for listing in the NRHP) contain *latte* components. Auditory impacts associated with range operations would not adversely affect the integrity of the 18 unevaluated artifact or ceramic scatters. Changes to the setting of two NRHP-eligible sites with *latte* components could be adverse (Table 5.2.10-3). There may also be an indirect effect to two unevaluated sites with *latte* components. If this alternative were selected, final assessments would be determined consistent with procedures in the 2011 PA.

Table 5.2.10-3. Summary of Archaeological Sites Potentially Affected by Noise

Site Type	*Period***	*Number of Sites of this Type in Impact Area*	*NRHP Eligible?*	*NRHP Criteria*
Pre-Contact Artifact Scatters	Pre-Contact	17	Not Evaluated	NA
Pre-Contact Ceramic Scatter	Pre-Contact/Latte	1	Not Evaluated	NA
Latte Sites	Pre-Contact/Latte	2	Yes	D
Latte Sites	Pre-Contact/Latte	2	Not Evaluated	NA

Legend: NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion D = eligible for potential to yield information important in prehistory or history.
Note: ** Revised to match Guam GHPI forms dated May 28, 2014.

No indirect adverse effects from visual intrusions associated with Alternative 2 are anticipated as the ranges would not be visible from most sites and the action would not involve a change in visual setting.

Access to all sites within the PIIA would be restricted during range operations; however, most of these sites are located within areas that currently have limited access due to operations at the NAVMAG or their remote locations. Members of the public have requested to visit areas of the NAVMAG in the past and there is a process to access certain areas. Therefore, indirect impacts could result from additional restriction on access to one potential TCP (a high density area of *latte* sites). The 2011 PA requires development of plans for regular public access to historic properties for DoD-controlled lands on Guam, subject to considerations including, but not limited to, public interest, public safety concerns and protocols, installation security, and emergency situations.

Summary of Impacts and Potential Mitigation Measures

Implementation of Alternative 2 could cause direct, adverse effects to nine known NRHP-eligible archaeological sites. Potential indirect adverse effects could occur to two NRHP-eligible sites with *latte* components and two unevaluated archaeological sites with *latte* components. One potential TCP could also be indirectly affected by reduced accessibility. In addition, culturally important natural resources could be directly impacted due to removal of limestone forest and savanna vegetation.

Under this alternative, adverse short-term effects from construction would be more than under Alternative 1, but fewer than Alternatives 3, 4, and 5. If this alternative were selected, final assessments would be determined consistent with the procedures identified in the 2011 PA. Adverse effects from operation could occur, but would be fewer than for Alternatives 3, 4, and 5. Refer to Section 5.7, Table 5.7-1 for a comparison of cultural resources impacts and potential mitigation measures for each LFTRC alternative.

The 2011 PA, as discussed in Section 3.1.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. Broadly, the 2011 PA includes processes to share information, consider views of the public, and develop mitigation measures when historic properties may be adversely affected. The 2011 PA provides measures for mitigating adverse effects to NRHP-eligible or listed archaeological sites, consulting on new projects and initiating additional identification efforts, and resolving impacts due to loss of access to potential TCPs or culturally important natural resources.

More specifically, the 2011 PA established a process for the review and analysis of potential effects to historic properties and other cultural resources for all alternative LFTRC locations. During October through December 2014, the DON consulted with the parties to the PA and the public on the TRRA, which provided information about cultural resources potentially affected by the LFTRC alternatives carried forward in the SEIS, consistent with PA Stipulation V.C. The TRRA provides information on

potential adverse effects resulting from the construction and operation of the selected LFTRC alternative to support consultation with the PA parties and the public. The DON will take all comments into account before reaching a final decision. For any alternative selected in the ROD, the 2011 PA stipulates that an RMP will be prepared to address effects from the construction and operation of the ranges. The RMP, developed in consultation with the consulting parties, will stipulate measures to avoid, minimize, and mitigate adverse effects to historic properties.

To the degree possible, direct and indirect impacts to historic properties and natural resources of cultural importance would be avoided or minimized during the planning process. Consultation under the 2011 PA would address potential adverse effects and alternatives to avoid adverse effects. Refer to Section 3.10 for more information on definitions and procedures. If avoidance is not possible, Table 5.2.10-4 presents potential mitigation measures to resolve adverse effects to historic properties and reduce impacts to cultural resources resulting from the implementation of Alternative 2. With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that direct and indirect, short- and long-term impacts, as defined under NEPA, could be reduced to a level below significance.

Table 5.2.10-4. Potential Mitigation Measures for Alternative 2 for Adverse Effects (NHPA) and Impacts to Other Cultural Resources (NEPA)

NHPA Effects	***Mitigation***
Potential direct adverse effects to nine historic properties--NRHP-eligible archaeological sites from construction and potential indirect adverse effects to 2 historic properties from changes in use that degrade site integrity.	Development and implementation of the RMP to identify specific measures to avoid, minimize, and mitigate direct and indirect adverse effects to historic properties.
Potential indirect effect one potential TCP from restricted access.	Development of an RMP to include options for access that consider public interest, public safety, and installation security for access to culturally sensitive locations.
Undetermined effects to 2 unevaluated sites.	If this alternative is selected in the ROD, unevaluated properties that may be affected would be evaluated consistent with the 2011 PA. If determined eligible for listing in the NRHP, appropriate mitigation measures would be developed to resolve any adverse effects.
NEPA Impacts	***Mitigation***
Potential impacts to culturally important natural resources.	Through the 2011 PA process, coordinate with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans to provide an opportunity to collect these resources consistent with installation security instructions and safety guidelines.

5.2.11 Visual Resources

5.2.11.1 Affected Environment

The 2010 Final EIS describes the proposed activities at NAVMAG (Volume 2, Chapter 2: Proposed Action and Alternatives, Section 2.3.1: Requirements, page 2-49). Although Alternative 2 differs from the 2010 Final EIS activities at NAVMAG, the potentially affected visual environment and the visual resources themselves would remain the same. A list and description of visual resources at the NAVMAG is provided in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.1.4.1: Naval Munitions Site, pages 13-54 to 13-75). NAVMAG is located in a large, bowl-shaped valley with a water reservoir (Fena Reservoir) near its center. This reservoir is the largest freshwater body on Guam, and it provides a substantial amount of the island's potable water supply. Like the rest of NAVMAG, the Fena Reservoir is not accessible to the public.

As noted in the 2010 Final EIS, the valley is surrounded by rugged terrain and several mountain peaks. Current NAVMAG facilities are almost entirely out of the public's view. Views from within the northern portion of NAVMAG are a blend of a naturally appearing landscape, interspersed with areas of earth-covered magazines and ordnance storage facilities. The southern portion of NAVMAG has mountainous topography and a rugged terrain. With the exception of some trails for off-road vehicles, almost no human-made features cover the landscape.

Implementation of Alternative 2 would involve acquisition of land to the east that is outside existing NAVMAG boundaries, and primarily has a natural landscape, as shown in Photo 5.2.11-1.



Photo 5.2.11-1: View looking east across NAVMAG near the top of the Lamlam Trail

Source: AECOM 2009.

5.2.11.2 Environmental Consequences

Impacts on visual resources from Alternative 2 would be the same as those provided in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.2-7: Summary of Impacts, pages 13-80 to 13-82). Table 13.2-5 in the 2010 Final EIS noted that no visual impacts would occur from implementing either the ammunition storage alternatives or the access road alternatives. Although the actual footprint and type of development for Alternative 2 would be different from that originally analyzed in the 2010 Final EIS, the visual impacts, or lack thereof, would remain the same.

Construction

During construction, activities and equipment would cause temporary view obstructions where recognized views currently exist. These direct visual impacts during the construction phase would be short-term and would be less than significant.

Operation

Once the proposed action is operational, visual resources would not be greatly affected because of the undulating topography that interrupts views into NAVMAG, the use of existing trails for access to Alternative 2, the limited scale of proposed development, and the lack of visibility of the Alternative 2

area from Mount. Lamlam, which is a National Landmark, and Mount Jumullong Manglo Overlook. Views towards the east from the publicly accessible Jumullong Manglo Overlook into NAVMAG, including views to those areas to be acquired, would not be substantially affected. Direct, long-term visual impacts would be less than significant.

5.2.12 Ground Transportation

5.2.12.1 Affected Environment

The affected environment for ground transportation resources under Alternative 2 includes transportation facilities internal to the site (range roadways and intersections). This section discusses existing conditions and assesses how the operations and construction of Alternative 2 would potentially affect transportation conditions for roadways and intersections internal to the site. Impacts to off-base (external) roadways and intersections are summarized in Section 6.1 of this SEIS.

5.2.12.2 Environmental Consequences

Construction

Potential construction impacts to ground transportation under Alternative 2 would be the same as those described in Section 4.1.12.2 for Alternative A. Potential direct and indirect impacts to ground transportation resources from construction would be minimized with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, there would be less than significant short-term impacts to on-base (internal) roadways.

Operation

Proposed access to Alternative 2 would be from Route 4 and existing roadways would be used wherever possible. However, this alternative requires the construction of an access road to allow all-weather operations. The proposed access road would utilize the existing Dandan Road from Route 4, run parallel to the northern boundary of the Dandan communications site, and then extend west to the ranges on improved all-weather roadways. Potential operational impacts for Alternative 2 would be the same as those described in Section 5.1.12.2 for Alternative 1; there would be no direct, long-term significant impacts to internal (range) roadway segments or intersections.

5.2.13 Marine Transportation

5.2.13.1 Affected Environment

Alternative 2 and SDZ would not extend over waters used by vessels. Thus, there would be no marine transportation in the proposed area.

5.2.13.2 Environmental Consequences

Implementation of Alternative 2 would not impact open waters used by vessels. Therefore, it is expected that there would be no impact to marine transportation due to the construction and operation of Alternative 2.

5.2.14 Utilities

5.2.14.1 Affected Environment

The affected environment for the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.14.1 of this SEIS.

Electrical Power

Electric power in the vicinity of Alternative 2 is supplied by a local GPA power distribution system. This system is buried underground within the existing Dandan Road, near the beginning of the proposed new access road. This system has 3-phase 13.8 kV service buried power lines, as well as manholes along Dandan Road. The distribution system primarily serves the Dandan communication installation and the Layon Landfill. There is currently no electrical power system at the specific areas for the proposed Alternative 2 facilities.

Potable Water

The potable water system near Alternative 2 includes a local GWA water distribution system buried underground in the existing Dandan Road, at the beginning of the proposed new access road. This system consists of underground water lines and manholes along Dandan Road, primarily serving the Dandan communication installation and the Layon Landfill. There is currently no water distribution system at the specific areas for the proposed Alternative 2 facilities.

Wastewater

The wastewater utility near Alternative 2 consists of an existing GWA underground wastewater collection system in the existing Dandan Road, at the beginning of the proposed new access road. This system consists of underground sewer lines and manholes along Dandan Road, primarily serving the Dandan communication installation and the Layon Landfill. There are currently no wastewater utility systems at the specific areas for the proposed Alternative 2 facilities.

Solid Waste

There are no solid waste facilities near Alternative 2. The Layon Landfill is located on Dandan Road past the beginning of the proposed new LFTRC access road. Dandan Road is the primary haul route for trash trucks going to this landfill.

Information Technology and Communications

There is no DoD IT/COMM infrastructure near Alternative 2. There are buried commercial IT/COMM lines along Dandan Road, but none in the specific areas of the proposed Alternative 2 facilities.

5.2.14.2 Environmental Consequences

Potential impacts to existing utilities from operation of the HG Range would be the same as discussed in Section 5.1.14.2.

Electrical Power

The proposed electrical system improvements for Alternative 2, as described in Sections 2.5.4.2 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The electrical power requirements of the LFTRC facilities would be small (less than 50 kW), and thus would have minimal impact on the current system or current power customers. During construction, there would be direct, short-term impacts on current customers consisting of potential limited power outages during construction. Power outages would be addressed through construction phasing or the use of temporary generators where necessary, which would minimize downtime.

The long-and short-term direct impact of Alternative 2 on the electrical utility would be less than significant, both during construction and in operation, because upgrades would be installed to accommodate the increased demand.

Potable Water

The proposed water system improvements for Alternative 2, as described in Sections 2.5.4.2 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The Range Maintenance Building and the KD Rifle/KD Pistol Range Administrative Building are the only LFTRC facilities requiring water service. A fire hydrant would also be provided for filling range fire fighting vehicles and general fire protection. The potable water demand of the LFTRC would be very small, estimated at an average daily demand of 26,520 gallons per day (100,389 liters per day). Therefore, a less than significant, direct long-term impact would occur to the current system. During construction, minor water service outages could occur as new water lines are connected to existing water lines. With careful planning these potential outages would be minimized.

The short- and long-term direct impacts of Alternative 2 on the potable water utility would be less than significant, during both during construction and in operation, because improvements would be made to meet the increased demand.

Wastewater

The proposed wastewater collection system improvements for Alternative 2, as described in Sections 2.5.4.2 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The only LFTRC facilities that would generate wastewater would be the Range Maintenance Building and KD Rifle/KD Pistol Range Administrative Building that have an estimated wastewater flow of less than 0.01 MGd (0.038 MLd). Due to the length required for a sewer line (approximately 7,710 feet [2,350 m]), the need for two pump stations, and proximity to Fena Reservoir; a holding tank has been recommended. This tank would be located adjacent to the Range Maintenance Building between the MPMG and Non-standard Small Arms Ranges. The holding tank would have to be pumped out periodically, and its contents taken to one of the existing WWTPs for treatment and disposal. A holding tank of 35,000 gallons (132,000 liters) would need to be emptied about once per week. The estimated sewer flow demand would be minimal and not impact other wastewater resources.

All other LFTRC facilities, including the HG Range, would be provided with portable toilets. These toilets would require periodic emptying, with the sewage then being taken to one of the existing WWTPs for treatment and disposal. The estimated sewage amount would be minimal and would not impact the current other wastewater resources.

The direct short- and long-term impacts from Alternative 2 on the wastewater utility systems would be less than significant, both during construction and in operation, because upgrades and portable facilities would be installed to meet the increased demand.

Solid Waste

The proposed solid waste improvements for Alternative 2, as described in Sections 2.5.4.2 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The estimated solid waste generation for LFTRC operations is small and this additional solid waste would not impact current waste collection, handling, or disposal operations. Suitable solid waste collection containers would be provided where required. The solid waste would be periodically collected, handled, and transported to the main cantonment transfer station for processing and disposal. The impact to solid waste from operations of Alternative 2 would be the same as discussed in Section 5.1.14.2 for Alternative 1.

Impacts to the solid waste handling effort during the U&SI construction phase involving the generation of green waste and C&D debris waste would be the same as discussed in Section 5.1.14.2 for Alternative 1.

The direct short- and long-term impact to solid waste from Alternative 2 would be less than significant, both during construction and in operation, because the additional waste volume would not exceed disposal capacity, and procedures for collection and transport would be established.

Information Technology and Communications

The proposed IT/COMM infrastructure improvements for Alternative 2, as described in Section 2.6, have been developed to meet the requirements for the proposed action. Since there are no existing IT/COMM resources near Alternative 2, there would be no impacts to existing IT/COMM services. New duct banks in Alternative 2 that would need to be installed include a duct bank of six 4-inch (10-cm) conduits interconnecting the LFTRC range facilities, including the HG Range. There would be inter-base connectivity required for DoD IT/COMM, as discussed in Section 2.6. Some of these inter-base connections in the southern part of Guam would require new rights of way.

The direct short- and long-term impact to the IT/COMM utility from Alternative 2 would be less than significant, both during construction and in operation, because upgrades would be installed to accommodate the increased demand.

5.2.15 Socioeconomics and General Services

Most issues and impacts associated with socioeconomics and general services encompass the entire proposed action (i.e., cantonment/family housing and LFTRC development, increased population), and do not vary with site alternatives. Accordingly, the impact discussion in Section 4.1.15 of this SEIS applies for all of the LFTRC alternatives and is incorporated here by reference. Land acquisition, however, is unique to the LFTRC alternatives, and the amount of land to be acquired varies by alternative. Therefore, this section focuses exclusively on the socioeconomic and sociocultural issues and impacts associated with the acquisition of land under Alternative 2 (with the exception of the HG Range, which would not require land acquisition).

5.2.15.1 Affected Environment

Table 5.2.15-1 displays baseline data for land that would be acquired for Alternative 2. A total of 1,894 acres (766.5 ha) of land would be acquired by the federal government. Most of the land (1,498 acres, 606 ha) is privately owned, including 17 of the 19 lots that would potentially be acquired. GovGuam owns 360 acres (146 ha) in a single lot that would be acquired under this alternative. One additional lot that would be acquired has unknown ownership.

Table 5.2.15-1. Potential Changes due to Land Acquisition, Alternative 2

	Acres (ha)
Potential Increase in Federal Land	1,894 (766)
Private Land Potentially Acquired	1,498 (606)
GovGuam Land Potentially Acquired	360 (146)
Guam Ancestral Land Commission Land Potentially Acquired	0
Chamorro Land Trust Commission Land Potentially Acquired	0
Unknown Ownership Land Potentially Acquired	36 (14.5)
	Lots
Number of Lots Potentially Acquired	19
GovGuam Lots Potentially Acquired	1
Guam Ancestral Land Commission Lots Potentially Acquired	0
Chamorro Land Trust Commission Lots Potentially Acquired	0
Private Lots Potentially Acquired	17
Unknown Lot Ownership	1

Table 5.2.15-2 shows existing land use in the NAVMAG (East/West) acquisition area. Land use on the NAVMAG East/West parcel consists of 1,498 acres (606 ha) of undeveloped land and 396 acres (160 ha) of conservation land (a portion of the Bolanos Conservation Area), where development is not allowed. The GBSP land classification for the entire acquisition area is Agriculture. However, as described in the Land Use Section 5.2.6, no current agricultural use was identified. None of the acreage currently has a productive economic use.

Table 5.2.15-2. Existing Land Use - NAVMAG East/West Parcel

Type of Land Use	*Acres (ha)*	*% Total Acreage*
Total	**1,894 (766)**	**100%**
Undeveloped Site in Natural State	1,498 (606)	79%
Conservation	396 (160)	21%

With regard to the affected fiscal environment of Guam, as stated in Section 5.1.15, GovGuam collected a total of $20.1 million in property tax revenues. These revenues accrue to the GovGuam general fund.

5.2.15.2 Environmental Consequences

The DON is required to comply with federal land acquisition laws and regulations, which include the requirement to offer just compensation to the owner, to provide relocation assistance services and benefits to eligible displaced persons, to treat all owners in a fair and consistent manner, and to attempt first, in all instances, acquisition through negotiated purchase. Specific policies and procedures, including the Uniform Act, are described in detail in Section 5.1.15.2.

While the government is authorized to acquire property through its powers of eminent domain (condemnation), it has been the consistent policy of the DON to acquire real estate through negotiation with owners. Even with a negotiated sale or lease however, "friendly" condemnation may be necessary to clear problems with title. The DON would comply with all applicable laws and regulations, including the Uniform Act.

In general, assuming voluntary sale or lease of property and conformance with land acquisition laws and regulations, land acquisition impacts from both a socioeconomic and sociocultural perspective would not be considered significant. Should condemnation be necessary as a last resort, while the landowner would be made economically whole by payment of fair market value, such an occurrence could represent an adverse sociocultural impact for that individual landowner. Such instances are expected to be extremely rare or nonexistent during implementation of this proposed action, and collectively would not represent a significant impact.

Socioeconomic and Sociocultural Impacts

Potential impacts associated with land acquisition could affect individual property owners, occupants, the surrounding community, and GovGuam. Economic impacts presented in this section are total impacts which include impacts that would be generated by the proposed action both directly and indirectly. Individual owners and occupants might be impacted from an economic perspective or a sociocultural perspective. Economic impacts associated with land acquisition are those that are purely financial. Sociocultural impacts associated with land acquisition are less tangible and are based on conceptual frameworks such as social disarticulation and cultural marginalization (the deterioration of social structures, networks, or belief systems), and social and psychological marginalization, stress, and anxiety (a person's loss of confidence in society and themselves, feelings of injustice, and reduced social status). See Appendix D, Section 5.2.2 for more detail.

Individual Owners/Occupants

With regard to economic impacts, if acquisition of privately-owned lots were to occur through negotiated purchase with the owners, there would be no adverse impact. As required under the Uniform Act, the purchase would take place at fair market value. Conversely, if the property was acquired through condemnation the federal government would still be required under the Uniform Act to reimburse the property owner at the fair market value. Therefore, the land acquisition would not cause an adverse economic impact to individual landowners.

With regard to sociocultural impacts, this alternative would require the acquisition of 19 separate lots, including one lot owned by GovGuam. Of the lots required, 17 are known to be privately owned and one lot has unknown ownership, so up to 18 different private parties could be affected. It is anticipated that, in all cases, a negotiated sale or lease between the federal government and a willing seller would be arranged, and there would be no adverse sociocultural impact. In the unlikely event that the land were acquired through condemnation, it is possible that the individual landowner would potentially consider the forced sale or lease of property to be an adverse direct, long-term impact (despite being paid fair market value).

Community

With regard to economic impacts, the NAVMAG (East/West) lands are either undeveloped in a natural state or represent conservation lands (see Table 5.2.15-2), and no current agricultural activities or other economically productive land uses were identified. Because the land that would be acquired does not currently have an economically productive use, and the fair market value would account for the highest and best use, there would be no adverse economic impact.

With regard to sociocultural impacts, the addition of an estimated 1,894 acres (766 ha) of federal land on Guam would be considered by some citizens to be an adverse impact due to the current extent of federal land that is under DoD custody and control (approximately 26% of all land on Guam, as shown in Section 5.1.15), which would increase to 27.3% with acquisition of the NAVMAG East/West parcel. However, because of the DON's commitment to the concept of "net negative," by the end of the Marine Corps relocation there would be no net increase in federal land under the custody and control of the DoD.

Five recreational sites are located in the vicinity of Alternative 2 (see Section 5.2.7). Four of the five recreational sites are located on NAVMAG and are only open to installation personnel and their guests. The remaining recreational site, Talofofo Falls Park and Hiking Trail, is accessible to the public along the existing access road between Route 4 and the Dandan Communication Site and is not located within the land acquisition boundary. Although access to Talofofo Falls Park and Hiking Trail may be temporarily affected during construction activities along the access road, the proposed construction activities along the access road would be short-term in duration and associated direct sociocultural impacts would be less than significant.

Government of Guam

The current 1,498 acres (606 ha) of land in the NAVMAG (East/West) parcel that are privately owned are subject to GovGuam property tax. The average per acre value for these parcels is $206,911. The total tax base for private lands is estimated to be $310 million ($206,911 x 1,498 acres). On this property, land owners pay an estimated $263,500 in property taxes to GovGuam. Acquisition of this property by the federal government would represent a loss of 1.3% of FY 2011 GovGuam property tax revenues, representing an adverse but less than significant impact.

GovGuam owns 360 acres (146 ha) of the land subject to acquisition under this alternative. At present, this land is not developed, leased or otherwise generating income for GovGuam. As such, either a sale or lease would generate a small beneficial direct economic effect (though less than significant in magnitude).

5.2.16 Hazardous Materials and Waste

5.2.16.1 Affected Environment

The current DoD ROI on Guam for hazardous materials and waste in this section includes DON property and GovGuam lands proposed for development of a LFTRC. The DON property includes the southern portion of the NAVMAG site and GovGuam lands include undeveloped lands east of the southern portion of the NAVMAG site, undeveloped areas between Dandan Communication Station and the proposed LFTRC site, as well the southern and western perimeter of the proposed training range SDZs.

Hazardous Material and Hazardous Waste Management

The affected environment or present conditions at NAVMAG with regards to hazardous materials and hazardous waste management would be the same as described in Section 3.16.1 of this SEIS, which provides a summary of hazardous materials, hazardous waste, toxic substances, and contaminated site information pertinent to Guam. Currently, there are three hazardous waste accumulation sites (NAWMU-1, B-870, NMC-EAD, B-901 and B-740, Ordnance) and two less-than-90 day storage areas (585B U.S. Navy Lab and B-404) located at NAVMAG (NAVFAC Pacific 2013a).

Contaminated Sites

No IRP sites are located in the vicinity of the portion of NAVMAG proposed for development for an LFTRC under Alternative 2 (Figure 5.2.16-1).

Military Munitions Response Program

No MMRP sites were identified in the vicinity of the area of NAVMAG proposed for development under Alternative 2.

Toxic Substances Management

Currently, the area of NAVMAG that would be affected by the proposed LFTRC is undeveloped and does not contain any structures. Therefore, LBP, ACM and PCBs would not be present.

According to USEPA, the parcel is located in an area classified as Zone 3 for Radon, indicating average indoor radon levels of less than 2 pCi/L.

5.2.16.2 Environmental Consequences

Construction

Hazardous Materials and Waste

Construction activities would result in a short-term increase in the use of hazardous materials and generation of hazardous waste that would cease at the completion of construction activity and would be the same as described in Section 5.1.16.2 of this SEIS. Should there be a need to import off-island earthen materials, all GEPA, Department of Agriculture, and local rules regulations would be followed.

Due to the short-term nature of the construction activity and the limited amount of hazardous materials and waste that would be used and generated, direct or indirect impacts would be less than significant.

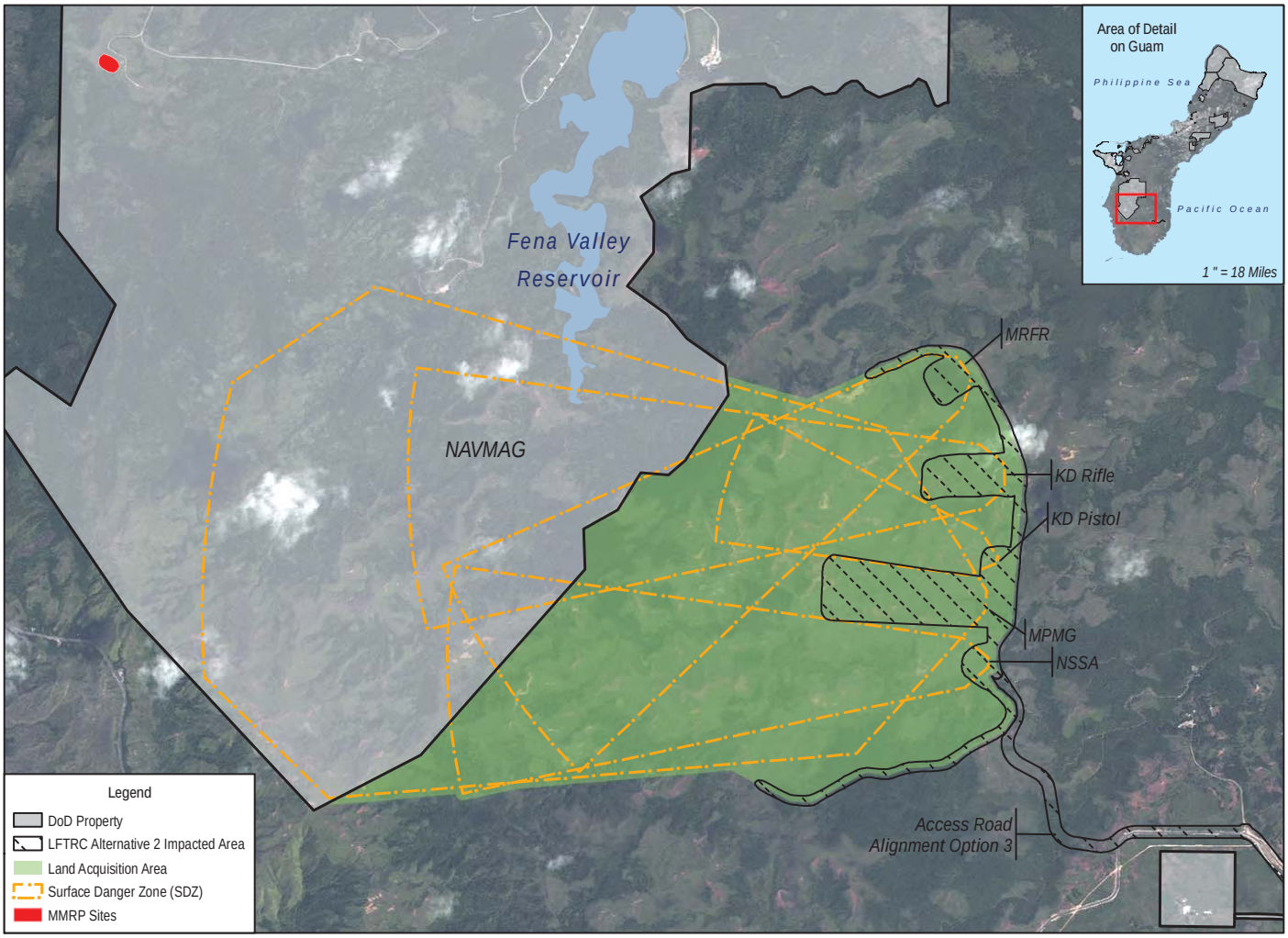


Figure 5.2.16-1
MMRP Sites in the Vicinity of NAVMAG (East/West) LFTRC Alternative 2

Contaminated Sites

No contaminated sites are known to be present in the proposed LFTRC area. Therefore, construction activities under Alternative 2 would have no direct or indirect impacts on contaminated sites.

Toxic Substances

Construction activities associated with Alternative 2 would have no direct or indirect adverse impacts on toxic substances. There are no structures in the proposed project area and these substances would not be used to construct proposed new facilities on Guam. Because the proposed construction areas are located in a USEPA Radon Zone 3, it is unlikely that new buildings, facilities and structures would encounter radon intrusion. Therefore, no direct or indirect impacts would occur during construction or operations.

Operation

Hazardous Materials

Live-fire training ranges would generate a long-term increase in the release of hazardous materials from expended training materials resulting from proposed new training operations, and associated impacts would be similar to those described in Section 5.1.16.2 of this SEIS; however, because the training ranges and associated SDZs would be land-based, there would be no direct impacts to open waters. As described in Section 5.1.16.2, direct or indirect impacts would be less than significant.

Hazardous Waste

Operation of the live-fire training ranges would result in a long-term increase in the generation of hazardous waste and would be the same as described in Section 5.1.16.2 of this SEIS. As described in Section 5.1.16.2, direct or indirect impacts would be less than significant.

Contaminated Sites

No contaminated sites are known to be present in the proposed LFTRC area. Therefore, Alternative 2 would have no direct or indirect impacts on contaminated sites.

Toxic Substances

Long-term operational activities associated with Alternative 2 would have no direct or indirect adverse impacts on toxic substances. These substances would not be generated by site operations. Because the proposed Alternative 2 is located in a USEPA Radon Zone 3, it is unlikely that new buildings, facilities and structures would encounter radon intrusion. Therefore, no direct or indirect impacts would occur during construction or operations.

5.2.17 Public Health and Safety

5.2.17.1 Affected Environment

Operational Safety

Currently, no vehicle access exists to the area proposed as Alternative 2. To protect the general public from intentional or accidental entry onto the NAVMAG property, locked or manned gates are used where vehicle access is provided, and a series of warning signs cautioning unauthorized personnel not to enter the area are posted along the perimeter of the installation. Unauthorized personnel are not allowed on the installation at any time.

A small arms range and sniper range are present on the west-central portion of NAVMAG. In addition, an emergency demolition range is in the central portion of NAVMAG, west of the Fena Valley Reservoir.

Both of these ranges are not within the Alternative 2 development area. Activities at these ranges are conducted in accordance with SOPs to ensure the safety of range participants and the general public.

The munitions operations and storage area as well as the emergency demolition range on NAVMAG have associated ESQD arcs that restrict the construction of inhabited buildings and other non-munitions related activities, to minimize potential impacts on personnel and the general public from an explosive mishap. Explosives handling and storage is the primary function within the munitions storage area. Detonation of UXO in emergency situations is the primary function of the emergency demolition range.

Environmental Health Effects

Noise

Aviation training is limited to four helicopter landing zones on NAVMAG. Landing Zones 2 and 4 are within proposed SDZs associated with Alternative 2 development. The overflight of helicopters produces noise. However, this training is infrequent and occurs at locations within the installation away from populated areas, resulting in no community noise effect. In addition, a small arms range and sniper range are internal to the installation and do not present a noise management issue.

Land demolition activities take place at the NAVMAG demolition range in the central portion of the installation, approximately 4,100 feet (1,250 m) from the closest public boundary. Although individuals exposed to these events may be startled if they are unaware of the source of the noise, the brevity and relative infrequency of activities does not result in noise contours extending onto adjacent public lands. Details regarding current noise conditions at NAVMAG are provided in Section 5.2.4.1.

Water Quality

The Fena Valley Reservoir, which is the primary drinking water source for the southern portion of Guam, is within the NAVMAG boundary. Water quality from the Fena Valley Reservoir and regional springs is generally high, requiring minimum treatment and chlorination for domestic use. Threats to water quality include sedimentation from accelerated erosion, eutrophication caused by persistent conditions of low dissolved oxygen, and fecal material contamination from animals (DON 2010a). Section 5.2.2.1 provides details regarding current quality of potable water sources.

Hazardous Substances

Current management practices and contingency plans for the use, handling, storage, transportation, and disposition of hazardous substances associated with NAVMAG ensure that exposure to the environment and human contact is minimized.

The IRP focuses on cleaning up releases of hazardous substances that pose risks to the general public and/or the environment. The MMRP focuses on identifying and removing MEC. No IRP or MMRP sites are situated within the Alternative 2 development area.

Unexploded Ordnance

The presence of UXO within the Alternative 2 area is unknown. However, Guam was an active battlefield during WWII. As a result of the occupation by Japanese forces and the subsequent assault by Allied/American forces to retake the island, unexploded military munitions may still remain.

Traffic Incidents

No high crash frequency locations have been identified in the vicinity of the Alternative 2 area.

5.2.17.2 Environmental Consequences

Potential impacts on public health and safety from implementation of Alternative 2 would be similar to those discussed for Alternative 1 (see Section 5.1.17).

Operational Safety

Construction Safety

Potential impacts from construction safety would be similar to those discussed for Alternative 1. During construction activities, a health and safety program would be implemented by the construction contractors based on industry standards for accident and pollutant release prevention. Because a health and safety program would be implemented for construction activities, and the general public would be excluded from entering construction areas, potential short-term construction impacts on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to construction activities is anticipated.

Operation/Range Safety

To protect the general public from intentional or accidental entry onto live-fire training ranges, a series of warning signs cautioning unauthorized personnel not to enter the area would be posted along the perimeter of the installation as well as at the range area. Unauthorized personnel would not be allowed on the installation or range at any time.

SOPs require that before conducting training activities, the general public and non-participating personnel would be cleared from the area so that the only public health and safety issue would be if a training event exceeded the safety area boundaries. Risks to public health and safety would be reduced by confirming that the training area is clear. The Range Safety Officer would ensure that hazardous areas are clear of personnel during training activities. After a live-fire event, the participating unit would ensure that weapons are safe and clear of live rounds.

Use of established training areas and compliance with appropriate range safety procedures would reduce the potential for interaction between the general public and personnel that are training. Specific and documented procedures would be in place to ensure the general public is not endangered by training activities. Therefore, Alternative 2 would result in no direct or indirect impact on public health and safety from operations and training activities.

Explosive Safety

For Alternative 2, SDZs have been defined for each of the ranges in the proposed LFTRC, to identify the areas requiring control of unauthorized access to live-fire training operations. The SDZs established for Alternative 2 reflect a "worst case scenario" for weapons use to ensure the safety of on- and off-range personnel and civilians. The proposed layout of the SDZs is provided in Chapter 2. With implementation of appropriate range safety procedures, no direct or indirect impact on public health and safety is anticipated from Alternative 2 activities.

The current munitions operations and storage area, as well as the emergency demolition range on NAVMAG, have associated ESQD arcs that restrict the construction of inhabited buildings and other non-munitions related activities to minimize potential impacts on personnel and the general public from an explosive mishap. The ESQD arcs overlap with SDZs associated with proposed live-fire training positions. Because the ESQD arcs do not overlay proposed live-fire training firing positions (only SDZs),

no conflict between the current munitions storage and EOD range activities with the proposed live-fire training activities would occur.

Although the SDZs for Alternative 2 activities do not encumber the existing breacher house, sniper range, or EOD range, they do encumber Landing Zones 2 and 4, and a portion of the non-firing maneuver area. Use of these areas would be prohibited when Alternative 2 is supporting live-fire training.

Ordnance used at Alternative 2 would be handled, stored, and transported in accordance with Marine Corps explosive safety directives (MCO P8020.10A, *Marine Corps Ammunition Management and Explosives Safety Policy Manual*), and munitions handling would be carried out by trained, qualified personnel. Therefore, no direct or indirect impacts related to explosive safety are anticipated.

Environmental Health Effects

Noise

Potential impacts on public health and safety under Alternative 2 noise would be similar to those discussed for Alternative 1. Increases in noise emissions associated with implementation of the short-term construction phase of this alternative with identified BMPs would be less than significant. Enforcement of OSHA guidelines for hearing protection for workers would be the responsibility of the construction contractors. Noise from Alternative 2 activities (i.e., weapons firing) would be heard on adjacent lands from the range. However, no residential land is near Alternative 2 and no people would be exposed to incompatible noise levels (see Section 5.2.4.2). The sound generated from Alternative 2 activities would be intermittent (only when training activities occur) and short term. Based on the modeled noise for Alternative 2 activities (see Section 5.2.4), the direct or indirect impact associated with noise on public health and safety would be less than significant.

Water Quality

Potential impacts on public health and safety from water quality concerns would be similar to those discussed for Alternative 1. Water withdrawal would likely increase. However, sustainability practices would be implemented to reduce the amount of water needed (see Section 5.2.2.2). The resulting total annual water withdrawal would be less than the sustainable yield, and monitoring of water chemistry would identify any emerging issues to ensure no harm to the water supply.

The Fena Valley Reservoir is within the NAVMAG boundary and is the primary drinking water source for the southern portion of Guam. The reservoir is located northwest of Alternative 2 and is outside established SDZs for live-fire training activities. The SDZs define the ground area needed to contain projectiles, fragments, debris, and components resulting from the firing, launching, and/or detonation of weapons. Because Alternative 2 activities would be contained within the designated SDZs, no direct or indirect impact on the Fena Valley Reservoir is anticipated.

Because measures would be taken to maintain a sustainable water supply and the Fena Valley Reservoir is outside the SDZs for Alternative 2 activities, public health and safety impacts from long-term increased demand on potable water and potential water-related illnesses would be less than significant.

Hazardous Substances

Potential safety impacts from use of hazardous substances would be similar to those discussed for Alternative 1. Implementation of this alternative would result in an increase in the use, handling, storage, transportation, and disposition of hazardous substances. These activities would be conducted in accordance with applicable hazardous material and waste regulations, and established BMPs and SOPs to

ensure the health and safety of workers and the general public is maintained. IRP and MMRP investigations and/or remediation activities on NAVMAG would continue in an effort to clean up past releases of hazardous substances that pose a risk to the general public and the environment, and receive regulator concurrence that necessary actions have been completed to ensure the safety of the general public. Because hazardous substance management and IRP/MMRP investigative/cleanup activities would be conducted in accordance with applicable regulations and established BMPs and SOPs, no direct or indirect impact on public health and safety is anticipated.

With regard to exposure to airborne toxic dust related to live-fire training activities and range maintenance, lead is the primary contaminant of concern. Very small lead particles can become airborne if wind, foot traffic, or maintenance activities disturb lead-contaminated soil. Firing ranges would be designed and constructed so that participating personnel are not exposed to airborne contaminants above permissible limits. The nearest residential population is located approximately 0.5 mile (0.8 km) to the north and emissions migrating off range would likely be much lower than on-site. Analysis of firing range emissions presented in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.2.7: Summary of Impacts, Table 5.2-8, page 5-36) indicated that operations emissions from firing range components would be well below significance criteria. Because range maintenance procedures ensure that participating personnel are not exposed to airborne contaminants above permissible limits and analysis of firing range emissions are below significance criteria, a less than significant direct or indirect impact on public health and safety from firing range activities is anticipated.

Unexploded Ordnance

Potential impacts from UXO would be similar to those discussed for Alternative 1. Excavation for building foundations, roads, underground utilities, and other infrastructure could encounter unexploded military munitions in the form of UXO, DMM, and/or MPPEH. Exposure to MEC could result in death or injury to workers. With the exception of public access provisions outlined through the 2011 PA process (see Section 4.4.10, Cultural Resources), the general public would be excluded from entering construction zones and training areas. To reduce the potential hazards related to the exposure to MEC, ESS documentation would be prepared to outline specific measures that would be implemented to ensure the safety of workers and the general public. BMPs that would be implemented would include having qualified UXO personnel perform surveys to identify and remove potential MEC items before beginning ground-disturbing activities. Additional safety precautions would include having UXO personnel supervision during earth-moving activities and providing MEC awareness training to construction personnel involved in grading and excavations before and during ground-disturbing activities. Because UXO would be identified and removed before beginning construction activities and construction personnel would be trained about the hazards associated with unexploded military munitions, potential direct or indirect impacts from encounters with UXO would be minimized and would be less than significant.

Traffic Incidents

The potential for long-term increased traffic incidents is small (5% increase [see Section 4.1.17.2]). Because no high crash frequency intersections are located near NAVMAG and the overall potential long-term increase in the number of traffic accidents as a result of the increase in personnel would be minimal, a less than significant impact is anticipated on the health and safety of the citizens of Guam from traffic incidents.

5.2.18 Environmental Justice and the Protection of Children

5.2.18.1 Affected Environment

The affected environment under the NAVMAG (East/West) alternative is considered to be the entire island of Guam, as discussed in Section 4.1.18.1 of this SEIS. The proposed action under Alternative 2 would be located in the southern region of Guam, as defined in Section 4.1.18.1. The villages of Santa Rita, Agat, Umatac, Talofofo, and Yona are within this region.

5.2.18.2 Environmental Consequences

Potential impacts to environmental justice populations under Alternative 2 would be to noise, recreation, land acquisition, and public health and safety. The impact analysis discussion provided in the following sections is focused primarily on operational impacts of implementing the proposed LFTRC Alternative 2, as LFTRC construction impacts as related to environmental justice would be minimal and short-term, with no measurable effect on Guam's special-status populations.

Noise

There would be no impact due to construction noise under Alternative 2 because construction activities would be in an unpopulated area of Guam. Construction areas would be at least 1 mile (1.6 km) away from the nearest receptors.

There would be no direct impacts due to live-fire training noise under this alternative because there would be no populated residential areas affected and none of the noise significance criteria stated in the Marine Corps Guidance memo for land use and noise exposure would be exceeded, as described in Section 5.2.4, Noise. There would be no indirect impacts because no population is affected and none of the significance criteria would be exceeded.

Recreation

There are several recreational resources in the area, as described in Section 5.2.7. Potentially-affected resources include Talofofo Falls Park and Talofofo Hiking Trail.

Construction and/or improvement to access roads on non-federal property would be required to reach the proposed ranges in this alternative. The construction impacts would be temporary in nature and would mostly be limited to slow construction and earth-moving equipment slowing access to recreational resources.

There are potential indirect impacts from firing range noise, which could lessen visitor enjoyment of publicly-accessible recreational resources in the area of the LFTRC. However, the impacts from Alternative 2 are less than significant due to the lack of existing recreational resources in the areas to be potentially acquired.

Tier 1: Are there any minority, low-income, or children populations that would be impacted?

Yes, the recreational resources in this area are generally used by all people of Guam, which includes a high proportion of racial or ethnic minorities, low-income individuals, and children.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?

No, minority and low-income populations and children are not disproportionately affected by the increase in demand to recreation areas, because the entire region has a minority or special status population. All people of Guam would be affected by impacts to recreational resources. Therefore, Alternative 2 would

not result in disproportionately high and adverse effects on minority or low-income populations nor would there be disproportionate risks to the health and safety of children.

Land Acquisition

There would be both beneficial and adverse direct and long-term impacts on adjacent and nearby land uses from the proposed access road/utility easements, as discussed in Section 5.2.6.2, Land and Submerged Land Use. In addition, there would be short and long-term direct and indirect significant adverse impacts to land ownership if there is an unsolicited sale of privately-owned land to the federal government for the proposed Alternative 2. Although there may be landowners who are interested in selling their land, land ownership impacts are considered significant until negotiations have been completed. There would also be other relocation activity and land acquisition, or long-term leases for roadway improvements, to implement this alternative.

Tier 1: Are there any minority, low-income, or children populations that would be impacted?

Yes, based on the data provided in Section 4.1.18-1, private landowners are likely to be racial minorities that live in areas with a higher poverty rate than the U.S.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?

No, because all of Guam is considered a racial and ethnic minority population, minorities would not experience disproportionately high and adverse effects due to land acquisition. Because federal regulations regarding land acquisition would ensure that significant economic impacts to landowners and occupants do not occur, low-income populations would not experience disproportionately high and adverse effects due to land acquisition. Land acquisition would not result in health and safety risks that would disproportionately impact children. Therefore, Alternative 2 would not result in disproportionate land use or socioeconomic impacts to minority and low-income populations or children as a result of land acquisition.

Public Health and Safety

No impacts to public safety are anticipated from operational safety concerns (i.e., explosive safety, electromagnetic safety, and construction safety). No impacts to public health and safety are anticipated from management of hazardous substances. Less than significant impacts are anticipated to public health and safety from firing range air emissions. Less than significant impacts are anticipated from construction and operational noise, water quality, and UXO.

Tier 1: Are there any minority, low-income, or children populations that would be impacted?

Yes, the populations of the villages affected by Alternative 2 have high percentages of racial minorities, low-income groups, and children.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?

No, impacts would not be disproportionate because regardless of where the LFTRC is located on Guam, high (relative to the U.S.) percentages of minorities, low-income residents, and children would be affected. As LFTRC alternatives may only occur on Guam (by international treaty), and all of Guam is considered to have a high proportion of minorities, low-income residents, and children, impacts cannot be considered disproportionate.

5.3 NAVAL MAGAZINE (NORTH/SOUTH) LIVE-FIRE TRAINING RANGE COMPLEX - ALTERNATIVE 3

Under Alternative 3, the proposed development of a live-fire training range complex would occur at NAVMAG North/South. Details about this alternative are provided in Section 2.5.4.3 and the proposed site is illustrated in Figure 2.5-4.

5.3.1 Geological and Soil Resources

5.3.1.1 Affected Environment

The affected environment for the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.1.1 of this SEIS.

The affected environment for geological and soil resources associated with Alternative 3 is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.1.5 South, pages 3-26 to 3-28), which is summarized below for reference. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for geological and soil resources, but it would reduce some potential impacts to geological and soil resources that were determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, as described in the analysis of environmental consequences for Alternative 3 below.

Alternative 3 would be located in the same mountainous area in south-central Guam as Alternative 2. Elevations within the Alternative 3 footprint range from approximately 200 feet (61 m) above MSL in the southeast near the Magazine Relocation Area to approximately 700 feet (213 m) MSL at the MPMG Range in the northwest. Fena Valley Reservoir lies southeast of the Alternative 3 footprint, just beyond the Magazine Relocation Area.

The portion of the Alternative 3 footprint where the ranges would be constructed is underlain primarily by old (Barrigada) limestone, the geologic setting for sinkholes (see Section 3.1.1.1). Based on available topographic and field data, four features have been preliminarily identified as sinkholes/depressions that may contain sinkholes within, or on the perimeter of, the proposed Alternative 3 footprint (Figure 5.3.1-1). The Magazine Relocation Area footprint is underlain by bedrock of volcanic origin. One bedrock fault crosses the proposed MPMG Range, and multiple faults are mapped in the nearby area surrounding the proposed Alternative 3 footprint.

The two dominant soil groups underlying Alternative 3 are the Ritidian-Rock Outcrop Complex and Akina silty clay (Figure 5.3.1-2). Soils within the footprint occur on undulating level to very steep slopes (Young 1988). For the Ritidian-Rock Outcrop Complex soil, runoff is very slow and the water erosion hazard is slight. For Akina silty clay, runoff is rapid and the water erosion hazard is severe (Young 1988). Urban Land Complex soils comprise the remainder of the proposed Alternative 3 footprint. For these soils, the water erosion hazard is low. Prime farmland soils, as defined by the USDA, are soils best suited to producing food, seed, forage, fiber and oilseed crops, favorable for economic production and sustained high yield, with minimal inputs of energy and resulting in least damage to the environment (Young 1988). None of the soils in the Alternative 3 footprint are suitable for agricultural purposes or are identified by the USDA as prime farmland (Young 1988).

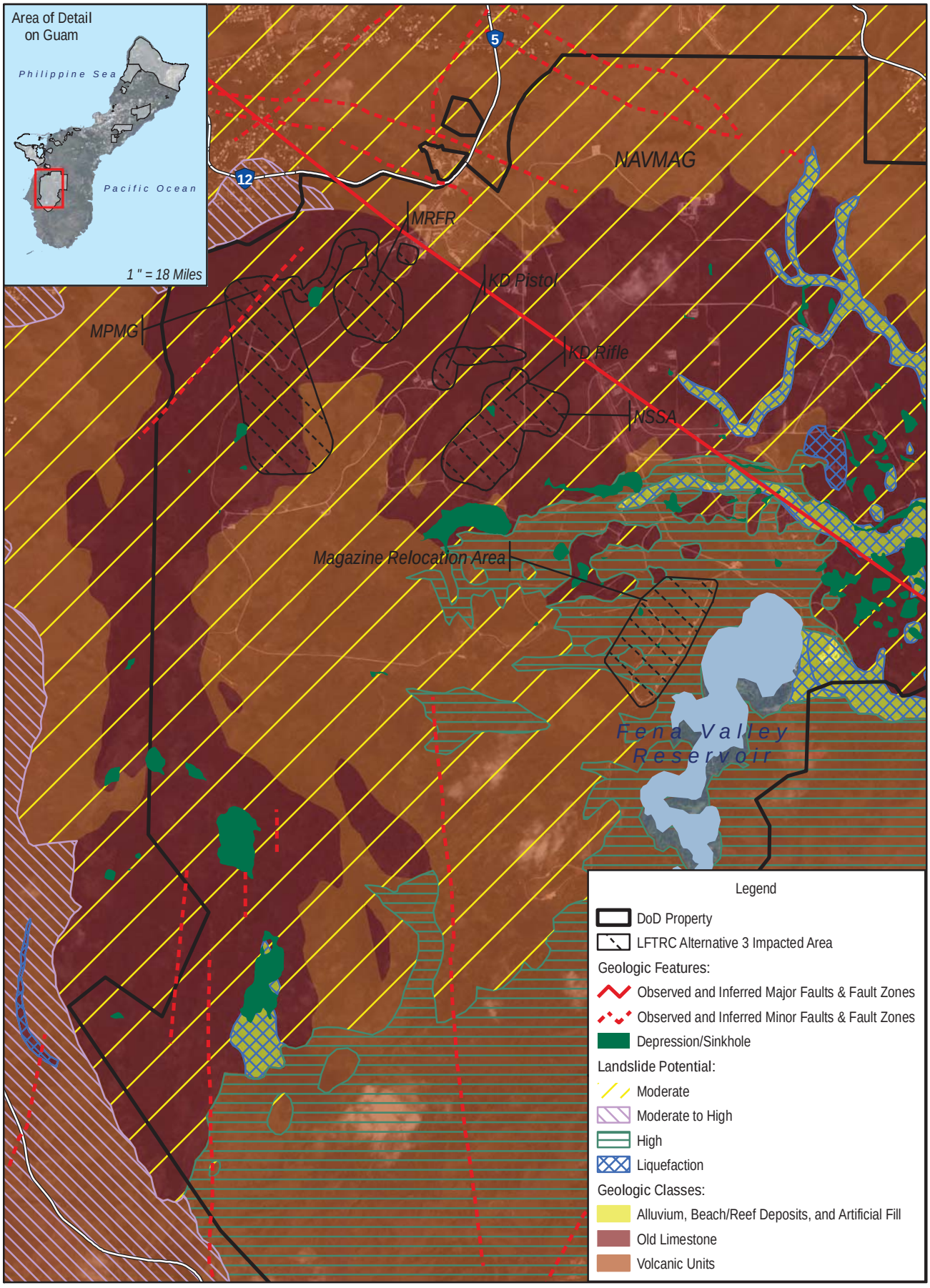
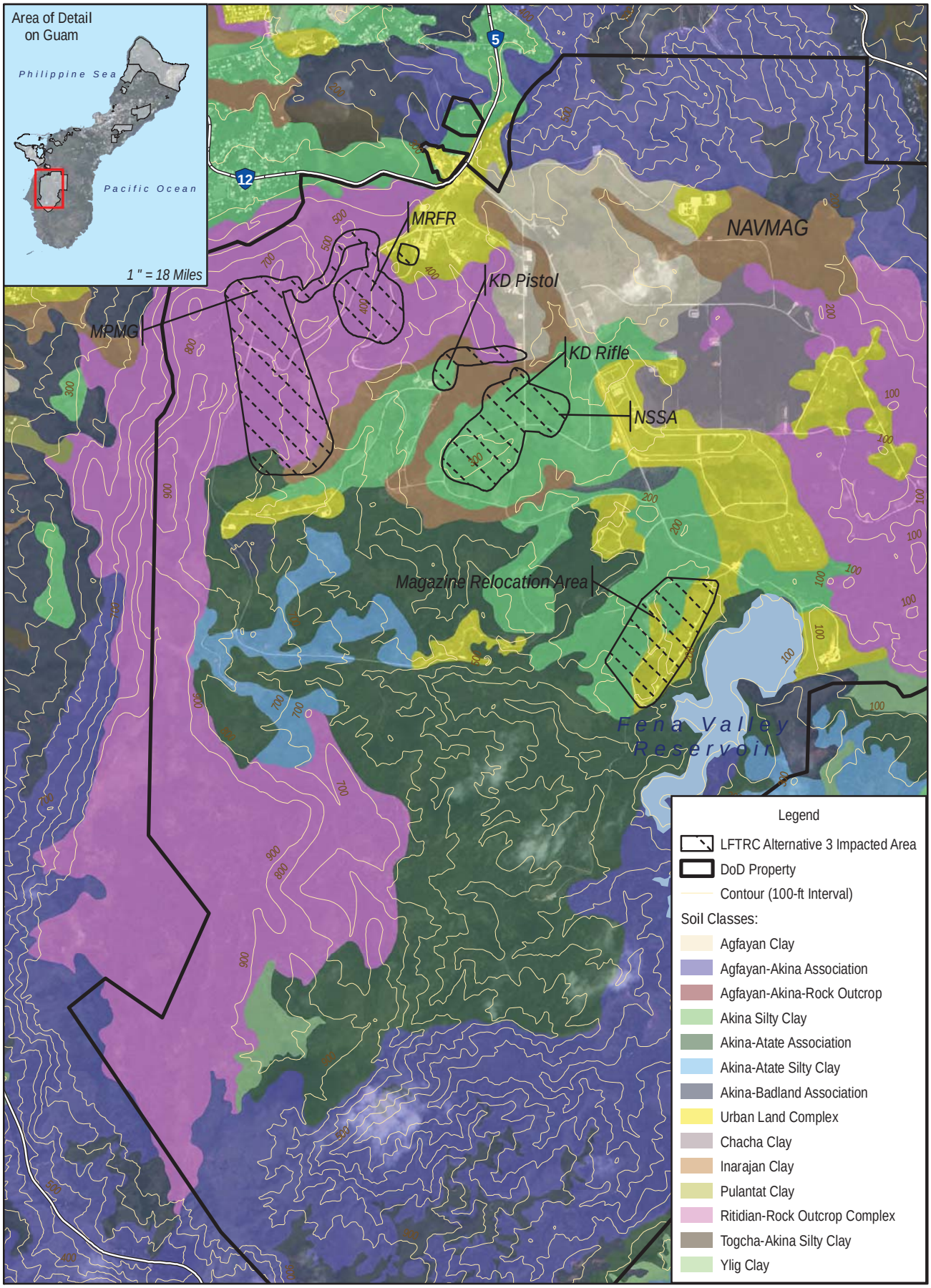


Figure 5.3.1-1
Geologic Features in the Vicinity of
NAVMAG (North/South) LFTRC Alternative 3

Sources: COMNAV Marianas 2008; GovGuam 2008; NAVFAC Pacific 2013; WERI 2001



0 0.3 0.6 Miles

0 0.4 0.8 Kilometers

Figure 5.3.1-2
Soils in the Vicinity of
NAVMAG (North/South) LFTRC Alternative 3

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Sources: NAVFAC Pacific 2013; NRCS 2006

With respect to geologic hazards (see Section 3.1.1.1), most conditions at the proposed Alternative 3 location are similar to those at Alternative 2 (i.e., consolidated bedrock underlying the site is not vulnerable to liquefaction, and the site elevation is higher than the maximum recorded tsunami wave run-up). However, unlike Alternative 2, the landslide potential for Alternative 3 is moderate. The limestone bedrock in the area of the Alternative 3 firing ranges presents a potential hazard of surface instability and collapse due to sinkholes. The Magazine Relocation Area would be located on volcanic bedrock, in which sinkholes typically do not form.

5.3.1.2 Environmental Consequences

Potential geology and soil impacts addressed in this section are limited to elements of the proposed action that could affect onshore landforms or that could be affected by geologic hazards. Potential soil contamination issues are addressed in Section 5.3.16.2 of this SEIS (Hazardous Materials and Waste).

Construction

Construction impacts associated with the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.1.2 of this SEIS.

Construction of the new ranges, range support building, roads, bridges, estimated 72 new concrete munitions magazines and related infrastructure associated with Alternative 3 would include clearing, grubbing and grading, and excavation (cut) and filling, and stream rerouting. Earthwork would include 4,932,976 yd^3 (3,771,530 m^3) of excavation (cut) and 3,130,058 yd^3 (2,393,100 m^3) of fill resulting in a net 1,802,919 yd^3 (1,378,430 m^3) of cut (DON 2013a). There are major differences in elevation in the areas planned for construction of the MPMG, KD Rifle, and MRF ranges. There would be substantial changes to surface elevation for construction of the MPMG, KD Rifle and MRF ranges (DON 2103b). Overall, Alternative 3 would involve the largest volume of excavation to construct of any of the action alternatives. Because of the major elevation changes, the substantial alteration of the surrounding landscape, and the amount of excavation, filling and contouring that would occur, Alternative 3 is expected to have a significant direct, long-term impact on topography. Potential mitigation is not considered feasible for this impact because smaller cut/fill volumes would not provide the necessary level surfaces for the referenced ranges. This significant impact to topography would occur with implementation of any LFTRC alternative except Alternative 2, which would involve the least amount of cut and fill (i.e., the impact would be the same for all alternatives except Alternative 2).

Construction of the HG Range would involve 8,894 yd^3 (6,800 m^3) of cut and 12,641 yd^3 (9,665 m^3) of fill, for a net of 3,747 yd^3 (2,865 m^3) of fill. The 1,802,919 yd^3 (1,378,430 m^3) of net cut generated by construction of the other Alternative 3 ranges would provide sufficient additional fill to supply the need at the HG Range.

The differences in elevation in the areas planned for construction of the MPMG, KD Rifle, and MRF ranges at Alternative 3 are substantially greater than the natural elevation differences in the Alternative 2 footprint. For example, to construct the MPMG Range at Alternative 2, a 30-feet (10-m) high slope would be leveled with about 942,500 yd^3 and (725,000 m^3) of cut and 910,000 yd^3 (700,000 m^3) of fill. To construct the same range at Alternative 3, a 75-to-100 feet (22 to 30 m) high slope would be leveled with 2.47 million yd^3 (1.9 million m^3) of fill. Due to the steeper topography in the Alternative 3 footprint, nearly 4 times as much excavation and 2.5 times as much fill overall would be needed to level the ranges for Alternative 3 as for Alternative 2. There is a potential for increased erosion, compaction, and soil loss from physical disturbance caused by construction activity and changes to existing topography. However, project design and construction would incorporate engineering controls as BMPs to minimize erosion

within the project construction footprint, as required by Title 22 of GAR, Chapter 10 Guam Soil Erosion and Sediment Control Regulations. Examples of such engineering controls are described in Section 5.2.1.2 of this SEIS.

In addition, construction activities associated with Alternative 3 would comply with the Construction General Permit. Potential construction-specific stormwater BMPs would be implemented in compliance with the Construction General Permit as listed in Section 4.1.2.2. Construction-specific stormwater BMPs would provide erosion and sediment control during the construction period, generally by employing on-site measures that reduce the flow of stormwater and minimize the transport of soils and sediment off-site. Fill material would be generated on-site, whenever possible. In addition, roadway-specific BMPs, as identified in the most recent *CNMI and Guam Stormwater Management Manual*, would be included in the planning, design, and construction of all roadways and facilities. Through compliance with 22 GAR Chapter 10 and the Construction General Permit and implementation of roadway stormwater BMPs, and because the rate of erosion and soil loss would not be substantially increased, direct, short-term impacts to soils from erosion during construction of Alternative 3 would be less than significant. In addition, no indirect, short-term impacts associated with soil erosion are expected.

The soils in the Alternative 3 footprint are not identified as prime farmland, and no existing agricultural use is identified for the area of disturbance (it is DoD property included within NAVMAG and the land is used for military purposes). Therefore, disturbance of soil during construction of Alternative 3 would have no direct or indirect short-term impacts to agricultural soils.

There are four topographic features that may contain sinkholes within, or on the perimeter of, the Alternative 3 footprint (see Figure 5.3.1.1). For any sinkholes discovered before or during construction, BMPs would include compliance with 22 GAR Chapter 10 § 10106F. In order to ensure compliance with 22 GAR Chapter 10 § 10106F, BMPs would be modified or an environmental and hydrogeologic assessment must be performed to ensure adverse effects will not result, including but not limited to the displacement of groundwater, interference with well production, significant changes to groundwater recharge, flooding, or the threat or introduction of any pollutant to groundwater. After a preferred alternative is selected and the ROD is signed for the proposed project, final design work would begin for the preferred alternative site. A geotechnical study, including subsurface borings, would be conducted to determine whether the depressions on the site contain sinkholes, and whether there are additional sinkholes not evident from the surface. Hydrogeological studies would be conducted to confirm groundwater flow at the site as well. The geotechnical and hydrogeological studies would be coordinated with the GEPA to design and implement an appropriate analysis. These studies would be part of the final design process and would take place before any construction begins. With implementation of these BMPs, and because no sinkholes would be filled that would adversely affect site drainage, no adverse impacts to sinkholes would occur. Therefore, construction of Alternative 3 would have less than significant direct, short-term impacts to sinkholes.

Hazards associated with earthquakes, fault rupture and slope instability would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 (USACE 2013). The Alternative 3 site is located inland and above the elevation prone to tsunamis, and so would not be susceptible to inundation. The consolidated limestone and volcanic bedrock underlying the site is not vulnerable to liquefaction. In addition, there would not be a change to soil and/or bedrock conditions that would increase vulnerability to a geologic hazard. As stated in the previous paragraph, 22 GAR Chapter 10 § 10106F requires that for sinkholes within the project development footprint that would be modified or used, an environmental and hydrogeologic assessment must be performed to ensure adverse effects will

not result. Compliance with these regulations would minimize potential geologic hazards associated with sinkholes. Therefore, construction of Alternative 3 would have less than significant direct and indirect short-term impacts with respect to geologic hazards.

Operation

Operational impacts associated with the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.1.2 of this SEIS.

Alternative 3 operations would not alter topography post construction, so no direct or indirect impacts to topography would occur.

The firing range activities and conditions and conditions that may directly cause or increase naturally occurring soil erosion during the operational phase would be the same as those described for Alternative 2 and are described in Section 5.2.1.2 of this SEIS. Similar to Alternative 2, under Alternative 3 the significant changes to topography during construction of the MPMG, KD Rifle, and MRF ranges could alter natural surface flow patterns that could increase soil erosion. Munitions storage in the relocated magazines would not involve any surface disturbance.

The area of impervious surfaces that would be constructed for the ranges and associated infrastructure (range buildings, roads, and parking areas) would comprise approximately 21.0 acres (8.5 ha) (Appendix F) including about 20.1 acres (8.1 ha) for Alternative 3 and about 0.9 acre (0.4 ha) for the HG Range. There would be a minor increase in runoff from the new impervious surface area as compared with existing conditions. Stormwater infrastructure improvements included as part of the proposed action would incorporate LID measures and BMPs to minimize soil erosion from this increased runoff. Where possible, stormwater flow paths would continue to mimic pre-development flows through area topography. Stormwater BMPs that would be implemented to minimize and control runoff would also minimize soil erosion.

The range complex would be managed in accordance with current Marine Corps range management policies and procedures, which are designed to ensure the safe, efficient, effective, and environmentally sustainable use of the range area. A thorough explanation of Marine Corps range management is detailed in the 2010 Final EIS (Volume 2, Chapter 2: Description of Proposed Action and Alternatives, Section 2.3.1.4: Firing General Military Skills, pages 2-55 to 2-59). Marine Corps range management policies and procedures include procedures for removing expended rounds from live-fire ranges with impact berms every 5 years, managing stormwater, controlling erosion, maintaining vegetation on berms and drainage ways and turf on the range, and restricting vehicular activities to designated/previously identified areas. Range roads would be maintained to minimize erosion.

There would be minor ground disturbance associated with utility maintenance. Construction stormwater BMPs would be implemented during maintenance activities to minimize and control runoff on-site and minimize potential effects of soil erosion.

There are no agriculturally productive soils or existing agricultural uses in the area of the proposed Alternative 3, so no direct or indirect long-term impact to agricultural soils would occur due to Alternative 3 operations.

A potential indirect impact of firing range operations includes the possibility of live ammunition causing wildland fires. As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's *Wildland Fire Management Plan* (USFS 2008). It would include protocols for monitoring fire conditions and adjusting training as needed. Units undergoing training at the

ranges would be briefed by range control on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). The existing *Wildland Fire Management Plan* (USFS 2008) that covers NAVMAG would be extended to cover bordering non-federal lands that could spread fire onto the ranges and would continue to be implemented under Alternative 3. With these measures, potential wildfires caused by the live ammunition would be unlikely. Effects to soils from erosion associated with wildfires associated with operation of Alternative 3 would be minimal and direct and indirect impacts would be less than significant.

With implementation of Marine Corps range management policies and procedures, fire suppression and potential mitigation measures, and stormwater BMPs (for ranges and ground-disturbing maintenance) less than significant direct and indirect long-term impacts to soils from erosion would occur due to Alternative 3 operations.

The BMPs for sinkholes would be implemented in the event that maintenance activities should involve sinkholes or their immediate perimeter, so there would be no adverse impacts. Therefore, Alternative 3 operations would have less than significant direct, long-term impacts to sinkholes.

Hazards associated with earthquakes, fault rupture and slope instability would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 (USACE 2013) during project design and construction, so direct and indirect long-term impacts with respect to seismic hazards would be less than significant. The consolidated limestone and volcanic bedrock underlying the site is not vulnerable to liquefaction. Alternative 3 is located inland and higher than the elevation prone to tsunamis, so it would not be susceptible to inundation. In addition, there would not be a change to soil and/or bedrock conditions that would increase vulnerability to a geologic hazard. Implementation of sinkhole BMPs would minimize potential geologic hazards associated with sinkholes. Therefore, Alternative 3 operations would result in less than significant direct and indirect long-term impacts associated with geologic hazards.

5.3.2 Water Resources

5.3.2.1 Affected Environment

The affected environment for water resources in the Alternative 3 NAVMAG ranges is described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.1.5.1: Naval Munitions Site, pages 4-68 to 4-71). A summary of site conditions for Alternative 3 is provided in Appendix F. The affected environment for the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.1 of this SEIS.

Surface Water

As indicated in the 2010 Final EIS, numerous rivers are located within the NAVMAG portion of the project area. The non-DoD portion of the project area is located along the headwaters of Agat, Taelayag, and Central Talofofo watersheds, but does not contain any surface waters (Figure 5.3.2-1).

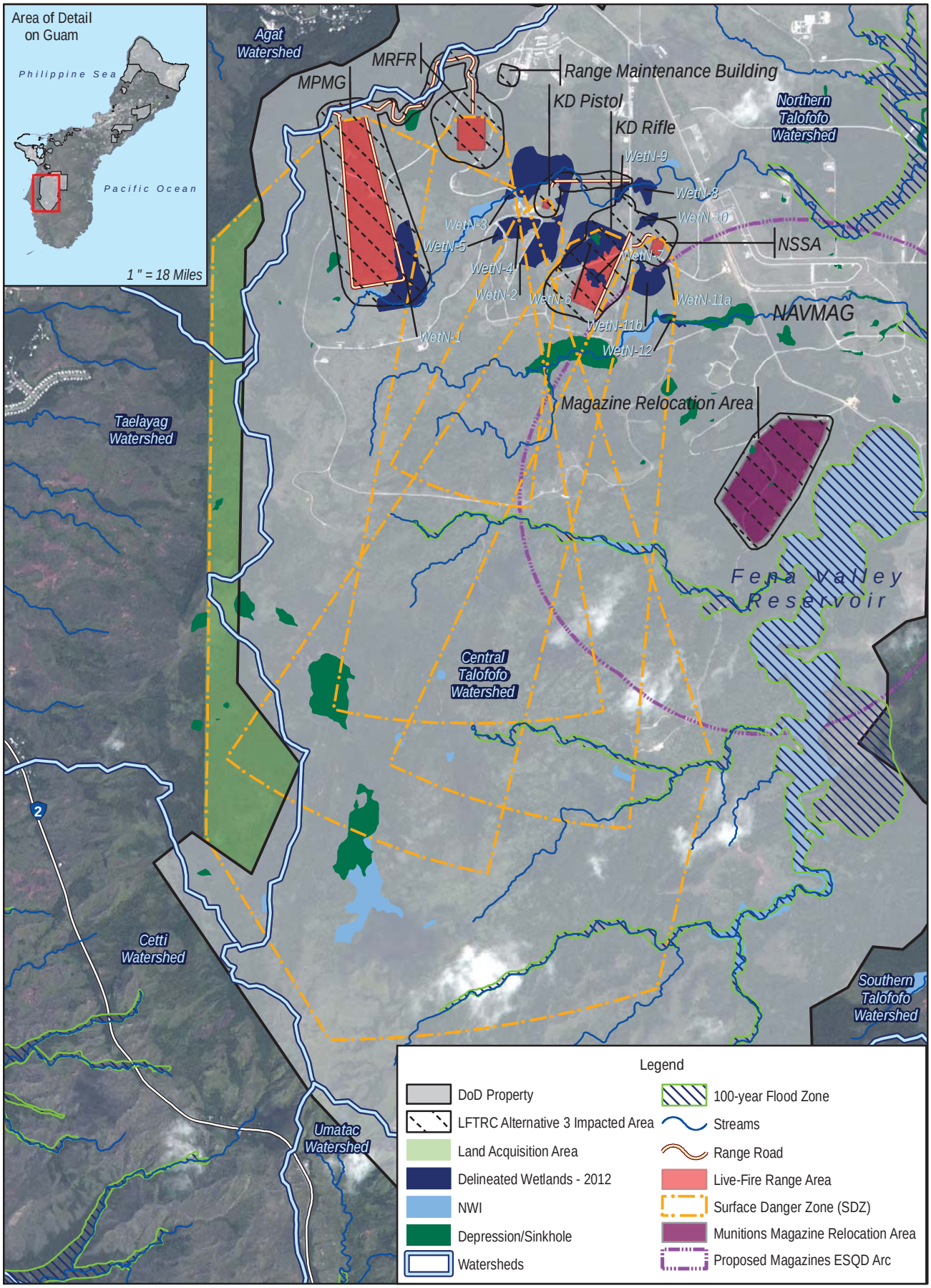


Figure 5.3.2-1
Surface Waters and Wetlands in the Vicinity of NAVMAG (North/South) LFTRC Alternative 3

Sources: WERI 2001; FEMA 2007; USFWS 2010; NAVFAC Pacific 2013, 2013a, 2013b

Specifically, the proposed construction areas and SDZ for the Alternative 3 ranges are spatially located along the Talisay and Bonya river systems of the Northern Talofofo Watershed and the Maulap, Almagosa, and Sadog Gago river systems of the Central Talofofo Watershed (note: referred to as the "Fena Reservoir Watershed" in the above referenced section of the 2010 Final EIS) (see Figure 5.3.2-1) (NAVFAC Pacific 2013a). The Talisay River includes numerous, unmapped, intermittent tributaries, which often connect the wetland features of the area. In the areas proposed for locating the various range footprints, the Talisay River transitions from a steep and incised channel, exhibiting step pool characteristics, to an undefined, wide, flooded swamp, becoming narrow only where it passes through road culverts. The Bonya River channel in project area is confined by topography and appears to be fairly stable, with few signs of recent bank erosion, and travels through heavily forested terrain. The Fena Valley Reservoir is located within the Central Talofofo Watershed (see Figure 5.3.2-1).

NAVMAG is characterized by dense forest vegetation, a significant road network, and restricted access. These three factors together contribute to a lower risk of arson fires, which affect many of the other upland, savanna-grassland dominated watersheds in Guam (i.e., the non-federal lands in Alternatives 2 and 4) (NAVFAC Pacific 2013a). Presence of a vegetative cover provides soil with natural erosion protection. If this cover is lost, due to a forest fire for example, then the potential for soil erosion increases substantially. The presence of a munitions storage facility within the NAVMAG boundaries and the need to protect property aboard the installation necessitates a few proactive measures such as (1) appropriate structural fire-prevention measures (fire breaks exist in some locations on NAVMAG), (2) effective fire-suppression policies (no smoking or open-air camp fires) are in place and strictly enforced, and (3) the installation can move quickly to respond to accidental fires (NAVFAC Pacific 2013a). There is an existing *Wildland Fire Management Plan* (USFS 2008) that covers NAVMAG.

The proposed Alternative 3 ranges are generally located on soils with naturally lower soil erosion potential as compared to the Alternatives 2 and 4 range alignments (NAVFAC Pacific 2013a). Also, these areas are covered with dense vegetation, which further reduces the likelihood of soil erosion. Soil disturbances resulting from ungulate (pigs, carabao, and deer) activity appears to be one of the major potential sources of soil erosion in this area. Persistent feeding and grazing creates well-worn trails that do not support vegetation and are therefore susceptible to getting eroded. Grazing activities also strip the understory, which results in loss of natural erosion control. The animals also regularly trample and dig in the soil for roots and tubers, which aggravates soil particle release (NAVFAC Pacific 2013a).

Soil erosion can degrade water quality in rivers and Fena Valley Reservoir and over time can diminish the storage capacity of Fena Valley Reservoir. Overall, the Alternative 3 project area is located primarily on various types of Akina soils, which are characterized by relatively high soil erosion potential and can produce high concentrations of very fine clay suspended sediments (NAVFAC Pacific 2013a).

The FEMA mapped 100-year floodplains are also shown in Figure 5.3.2-1. There are no 500-year floodplains in the project vicinity.

Groundwater

As indicated in the 2010 Final EIS, groundwater is found primarily in the low-permeability volcanic rocks and there is currently no groundwater extraction in the Alternative 3 project area.

Nearshore Waters

As indicated in the 2010 Final EIS, there are no nearshore waters located near the Alternative 3 project area due to its interior location on Guam. However, the Talofofo River discharges into the nearshore waters of Talofofo Bay (see Figure 5.2.2-1).

Wetlands

As indicated in the 2010 Final EIS, there are extensive wetlands in the Alternative 3 project area. Recent on-site wetland confirmation surveys were conducted at NAVMAG in May and November 2012 for this SEIS. The on-site confirmation was a non-jurisdictional wetland delineation (delineation being the establishment of wetland boundaries). A jurisdictional delineation establishes the boundaries of wetlands that are subject to requirements in the CWA and its implementing regulations and requires the approval of the USACE.

The wetlands identified during the 2012 survey are palustrine emergent wetlands with persistent vegetation that are seasonally flooded/saturated (PEM1E); palustrine forested wetlands that are semi-permanently flooded (PFO3F); or palustrine scrub/shrub vegetation that are seasonally flooded/saturated (PSS3E). The 2012 field survey delineated a total of 36.9 acres (15.0 ha) of wetlands in the project area as shown in Table 5.3.2-1 and Figure 5.3.2-1 (NAVFAC Pacific 2013b). This area includes 3.3 acres (1.3 ha) of forested wetlands as mapped by USFS (2006). All of these wetlands are all considered potentially jurisdictional pending a Jurisdictional Determination by the USACE.

For portions of the project area located outside the 2012 field survey, NWI data was used (NWI maps indicate the potential for wetland areas, but are not official determinations). The NWI maps indicate 0.7 acre (0.3 ha) of NWI wetland areas as shown in Table 5.3.2-1 and Figure 5.3.2-1 (USFWS 2010). The NWI wetlands are identified as palustrine scrub/shrub vegetation that are seasonally flooded (PSS1C). The project area outside the 2012 survey area would require a wetland delineation survey and review by the USACE to verify the location and size of any wetlands and whether they are jurisdictional.

Table 5.3.2-1. Summary of Wetland Acreages for Alternative 3

Wetland Type	*Wetland Area (acres [ha])*
Delineated Wetlands within the 2012 Survey Area	
PEM1E*	32.6 (13.2)
PFO3F*	2.9 (1.2)
PSS3E*	1.4 (0.6)
NWI Wetlands Outside the 2012 Survey Area	
PSS1C*	0.7 (0.3)
Total	**37.6 (15.3)**

Note: *Wetland types are based on the classification of Cowardin *et al.* 1979).
Sources: USFWS 2010; NAVFAC Pacific 2013b.

5.3.2.2 Environmental Consequences

Construction

General construction impacts to water resources would be similar to those described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.4: South, page 4-112) and under Alternative A in Section 4.1.2.2 of this SEIS. Alternative 3 would occur in an area that contains waters of the U.S. and would be required to comply with the Construction General Permit as described under Alternative A in Section 4.1.2.2 of this SEIS. Construction impacts associated with the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.2 of this SEIS.

Under Alternative 3, the proposed LFTRC construction activities at NAVMAG would result in the potential for a short-term increase in stormwater runoff, erosion, and sedimentation. However, through compliance with the Construction General Permit and Program SWPPP and implementation of a site-specific SWPPP and associated erosion control, runoff reduction, and sediment removal BMPs (see Table

4.1.2-2), these effects would be minimized. Specifically, the site-specific SWPPP would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flowrate of runoff and thereby minimize transport of suspended sediment through settling and promote infiltration of runoff.

Surface Water

Surface waters that are potentially affected by the various project footprints are shown in Figure 5.3.2-1. The KD Rifle, MPMG, MRF ranges and the northern portion of the Non-standard Small Arms Range would drain to the Talisay River. The remaining portion of the Non-standard Small Arms Range and the KD Pistol Range would drain to the Bonya River (NAVFAC Pacific 2013a). The range road would cross the Talisay River. The Magazine Relocation Area would be located in the Central Talofofo Watershed and has the potential to contribute to sedimentation of Fena Valley Reservoir.

Construction activities under Alternative 3 would include clearing of vegetation, grading (cut and fill), permanent or temporary accumulation of soils, stream rerouting, and filling in of natural areas. Potential effects from stormwater runoff would be minimized by adhering to the provisions of the Construction General Permit and implementing of a Program SWPPP and site-specific SWPPP and associated BMPs that would address site- and activity-specific surface water protection requirements. Implementation of construction BMPs under Alternative 3 would also minimize sedimentation impacts to Fena Valley Reservoir.

Construction activities that involve substantial earth moving, and those activities that are within or near stream channels would be scheduled for the dry season (January to May) to the extent possible (NAVFAC Pacific 2013a). Measures to minimize erosion within the project construction footprint, stabilize banks, and protect stream channels would be the same as described under Alternative 2 in Section 5.2.2.2 of this SEIS. Given the short-term nature of potential surface water impacts, compliance with Construction General Permit requirements, and implementation of BMPs, construction activities associated with Alternative 3 would result in less than significant direct and indirect short-term impacts to surface water.

Groundwater

Construction activities under Alternative 3 would include stormwater runoff protection measures that would also serve to protect groundwater quality. By adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific water resource protection requirements, there would be a reduction in stormwater pollutant loading potential and thus a reduction in pollution loading potential to the underlying groundwater basins. Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs), construction activities associated with Alternative 3 would result in less than significant direct short-term impacts to groundwater.

Nearshore Waters

Construction activities under Alternative 3 would occur more than 1.0 mile (1.6 km) from the coastline and would not result in direct impacts to the nearshore waters from stormwater runoff. Compliance with the Construction General Permit and implementation of BMPs under Alternative 3 would protect water quality in the Talofofo River and ensure that stormwater runoff from the project area would not cause indirect impacts to nearshore waters in Talofofo Bay (see Figure 5.2.2-1). Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs), construction activities associated with Alternative 3 would result in no impacts to nearshore waters.

Wetlands

Implementation of Alternative 3 could result in long-term, direct impacts to up to 36.9 acres (15.0 ha) of potentially jurisdictional wetland areas (see Figure 5.3.2-1). These direct impacts would be at the MPMG and KD Rifle ranges and range roads. There are an additional 0.7 acre (0.3 ha) of NWI wetlands in portions of the project area that have not been surveyed (see Section 5.3.2.1 in this SEIS).

Direct impacts (fill) to jurisdictional wetlands would be a significant impact. If these wetland areas are determined to be jurisdictional by the USACE, and therefore subject to Section 404 requirements, the Marine Corps would first attempt to avoid impacts. If avoidance is not possible, then the Marine Corps would obtain a Section 404 permit from the USACE to fill the wetlands and comply with the potential mitigation measures outlined in the permit (see Table 5.7-1). Unavoidable direct impacts to jurisdictional wetlands would be mitigated by creating new wetlands, restoring or enhancing existing wetlands, or preserving existing wetland areas on Guam to, at a minimum, replace the area filled at a mitigation ratio greater than 1:1.

As described under Alternative 2, a mitigation plan would be prepared under Alternative 3 as part of the Section 404 permitting process. If Alternative 3 is chosen and wetlands cannot be avoided, the Marine Corps understands that a LEDPA determination must be made as part of the permitting process and that if the USACE determines this alternative is not the LEDPA, a Section 404 permit under the CWA cannot be granted and Alternative 3 would not be implemented. Through implementation of the potential mitigation measures and procedures identified above, significant impacts to wetlands would be reduced to a level below significant. By comparison, Alternatives 1 and 5 would have no impacts to wetlands and Alternatives 2 and 4 would have significant long-term, direct impacts to up to 17.7 acres (7.2 ha) and 25.2 acres (10.2 ha) of potentially jurisdictional wetland areas, respectively, which would be mitigated to a level below significant.

There would also be potentially jurisdictional wetlands adjacent to and downstream of construction areas that would be subject to potential indirect impacts during construction. These short-term, indirect impacts would be minimized by adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific stormwater runoff protection requirements.

Operation

Alternative 3 would incorporate the concept of LID in the final planning, design, and permitting of the stormwater runoff and drainage design as described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-85 to 4-87) and under Alternative A in Section 4.1.2.2 of this SEIS. Operation impacts associated with the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.2 of this SEIS.

Under Alternative 3, there would be a minor increase in the area of impervious surface as a result of ranges and associated support facilities, which would result in an associated increase in stormwater discharge intensities and volume. However, the proposed action would incorporate LID measures and BMPs to ensure stormwater retention would be consistent with local and federal requirements and thus minimize potential impacts to surface water quality. Alternative 3 would also be implemented in accordance with all applicable orders, laws, and regulations including the preparation and implementation of a SWPPP, SWMP, and SPCC plan that would control runoff and minimize potential leaks and spills. Where possible, stormwater flow paths would continue to mimic pre-development flows through area topography.

Alternative 3 would include implementation of the REVA program and range management preventative measures (i.e., vegetation, pH adjustment, LID). As listed in Section 2.8 of this SEIS, the BMPs would reduce the potential for contaminants to migrate off-site. In addition, the DoD would investigate additional technologies that could assist with range design and management to minimize potential impacts. Available baseline data regarding range site conditions would be reviewed and verified prior to range construction and regular monitoring would occur during operations to verify the effectiveness of BMPs. For each range, water quality treatment strategies would be selected to achieve reductions of non-point source pollutants to meet the same water quality requirements as identified under Alternative A in Section 4.1.2.2 of this SEIS.

Surface Water

The *Watershed Reconnaissance Study* (NAVFAC Pacific 2013a) identified potential direct and indirect impacts to surface waters during the operational phase of Alternative 3, as described under Alternative 2 in Section 5.2.2.2 of this SEIS (see Appendix F). Potential effects from stormwater runoff would be minimized through the implementation of an appropriate and comprehensive stormwater management plan utilizing a LID approach and BMPs under Alternative 3. Firing range operational-phase LID measures and BMPs would focus on reducing volume and velocity of stormwater runoff, minimizing soil erosion potential within the range boundaries, and controlling the spread of lead bullets and bullet fragments. Implementation of the REVA program and BMPs for containing and limiting off-site migration of lead contaminants would be the same as described under Alternative 2 in Section 5.2.2.2 of this SEIS and are listed in Section 2.8 of this SEIS.

Appropriate fire suppression and potential mitigation measures would also be incorporated into the design (fire resistant structures) and range operating procedures as described under Alternative 2 in Section 5.2.2.2 of this SEIS. Alternative 3 would have a reduced fire susceptibility compared to Alternative 2. The existing *Wildland Fire Management Plan* (USFS 2008) that covers NAVMAG would continue to be implemented under Alternative 3. Therefore, the risk of exposing soils to erosion due to arson or natural wildland fires would be relatively low under Alternative 3 because the ranges would be located within NAVMAG.

Because none of the proposed Alternative 3 firing range footprints fall within the Central Talofofo Watershed, stormwater runoff from the proposed range footprint areas would not drain to the Fena Valley Reservoir. The Magazine Relocation Area would be located in the Central Talofofo Watershed and has the potential to contribute to sedimentation of Fena Valley Reservoir. However, the magazine would include appropriate LID measures and BMPs to minimize erosion within the project construction footprint and transport of sediment to surface waters. The SDZ associated with Alternative 3 would partially overlay the Central Talofofo Watershed (see Figure 5.3.2-1), but potential impacts to the water quality of Fena Valley Reservoir from expended projectiles would be negligible as described under Alternative 2 in Section 5.2.2.2 of this SEIS.

No buildings/structures would be constructed in the 100-year or 500-year flood zone. It is anticipated that developing the proposed footprint areas would not impact water surface elevation levels in FEMA-regulated floodplains. However, this would be confirmed through detailed hydraulic and hydrologic modeling during the final design phase. Any rise in the elevations would be covered by FEMA regulations and would need to be approved by the local floodplain administrator.

Alternative 3 would be conducted in accordance with all applicable orders, laws, and regulations including the preparation and implementation of a SWPPP, SWMP, and SPCC Plans that would control runoff and minimize potential leaks and spills. Given implementation of these stormwater runoff

protective measures and range operation BMPs for containing and limiting the migration of lead contaminants, operations associated with Alternative 3 would result in less than significant direct or indirect long-term impacts to surface water.

Groundwater

Under Alternative 3, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would also serve to protect groundwater quality and recharge. Specifically, implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that any stormwater runoff recharging to groundwater basins would be of acceptable quality. BMPs to minimize lead transport would minimize contamination of groundwater. Given stormwater runoff protection measures (e.g., implementation of the REVA program, LID, and SWPPP measures), operations associated with Alternative 3 would result in less than significant long-term, direct impacts to groundwater.

Nearshore Waters

Under Alternative 3, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would also prevent direct impacts to the nearshore waters from stormwater runoff. Implementation of LID measures and BMPs under Alternative 3 would protect water quality in the Talofofo River and ensure that stormwater runoff from the project area would not cause indirect impacts to nearshore waters in Talofofo Bay. Given stormwater runoff protection measures (i.e., implementation of LID, BMPs, and pollution prevention plans), operations associated with Alternative 3 would result in no impacts to nearshore waters.

Wetlands

Under Alternative 3, proposed operations have the potential to cause indirect effects to nearby down-gradient wetland areas (see Figure 5.3.2-1). However, the stormwater runoff protection measures identified above would also serve to protect water quality entering wetlands. Specifically, implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that the stormwater runoff flowing into wetlands would be of acceptable quality. Given stormwater runoff protection measures (i.e., implementation of LID, BMPs, and pollution prevention plans), operations associated with Alternative 3 would result in less than significant long-term, indirect impacts to wetlands.

5.3.3 Air Quality

5.3.3.1 Affected Environment

The areas around Alternative 3 are not developed and no sensitive populations are present. Ambient air quality conditions in these areas can be considered typical for a rural area and include few activities involving operation of major stationary or mobile sources.

5.3.3.2 Environmental Consequences

Construction activities under Alternative 3 would be similar to Alternative 1, with the exception of site location. Therefore, the predicted construction activity annual emissions would be the same as Alternative 1, as summarized in Table 5.1.3-2. Emission would be well below the significance criterion of 250 tpy.

The hot-spot air quality impacts during both construction and operational phases would be similar to Alternative 1, as discussed in Section 5.1.3; resulting in less than significant short- and long-term hot-spot air quality impacts.

5.3.4 Noise

5.3.4.1 Affected Environment

Generally similar to the area southeast of NAVMAG, the mountainous southern-central portion of Guam contains Fena Valley Reservoir and NAVMAG, with very few people residing in areas that are immediately adjacent to the north portion of NAVMAG. The community of Santa Rita lies to the north and west over a small hill. Current noise sources in this area include light traffic noise and noise consistent with suburban neighborhoods. Acoustically, this area would be typical of a rural/suburban setting with ambient noise levels in this area of approximately 45-55 dBA (USEPA 1978).

5.3.4.2 Environmental Consequences

Construction

There would be no impact due to construction noise under Alternative 3 because construction activities would be in a sparsely populated area of Guam. Construction areas would be approximately 0.25 mile (0.4 km) away from the nearest receptors, a distance that is far enough away from the source of construction noise such that there would be minimal noise effects on receptors.

Operation

Alternative 3 would be located on the east slope of the ridgeline separating NAVMAG from the community of Agat and Santa Rita. Under Alternative 3, Zone 2 noise contours cover approximately 31 acres (12 ha) beyond the boundaries of NAVMAG and Zone 3 would all be within NAVMAG property. The off-base acreage would extend towards the north and west of NAVMAG. Modeling results (Army 2013) for Alternative 3 are shown on Figure 5.3.4-1. No houses are present within the noise contours so no residents would be affected by Zone 2 or Zone 3 noise contours. Approximately 70-80 homes would be within the Zone I noise contours in the area along Route 12 adjacent to Our Lady of Guadalupe Church and would experience noise levels between 55 and 60 dB ADNL. Another approximately 100 homes would be within the Zone 1 contours in Agat near the Pagachao Guam Housing and Urban Renewal Authority housing area with noise levels of 55 to 68 dB ADNL. Although noise would be greater than existing levels, this area would still be considered compatible for residential use. Noise may be less than predicted because the area is on the opposite side of the hill from the proposed firing line and the area is heavily wooded. Both of these factors attenuate sound levels. Table 5.3.4-1 lists Noise Zones 2 and 3 and the associated acreage affected within each zone.

Table 5.3.4-1. Noise Exposure within Noise Zones under NAVMAG (North/South) LFTRC Alternative 3

Noise Zone (dB DNL)[1]	*Acreage (ha)*		*Population*	
	On-base	*Off-base*	*Houses*	*People*
Noise Zone 2				
65 - 69	693 (281)	30 (12)	0	0
70 - 74	501 (203)	1 (0)	0	0
Total Zone 2	**1,194 (484)**	**31 (12)**	**0**	**0**
Noise Zone 3				
75 - 79	220 (89)	0	0	0
80 - 84	105 (43)	0	0	0
85+	186 (75)	0	0	0
Total Zone 3	**511 (207)**	**0**	**0**	**0**
Grand Total	**1,705 (691)**	**31 (12)**	**0**	**0**

Note: [1]Zone 1 is not listed because all land uses are compatible within Zone 1.
Source: Army 2013, NAVFAC Pacific 2013.

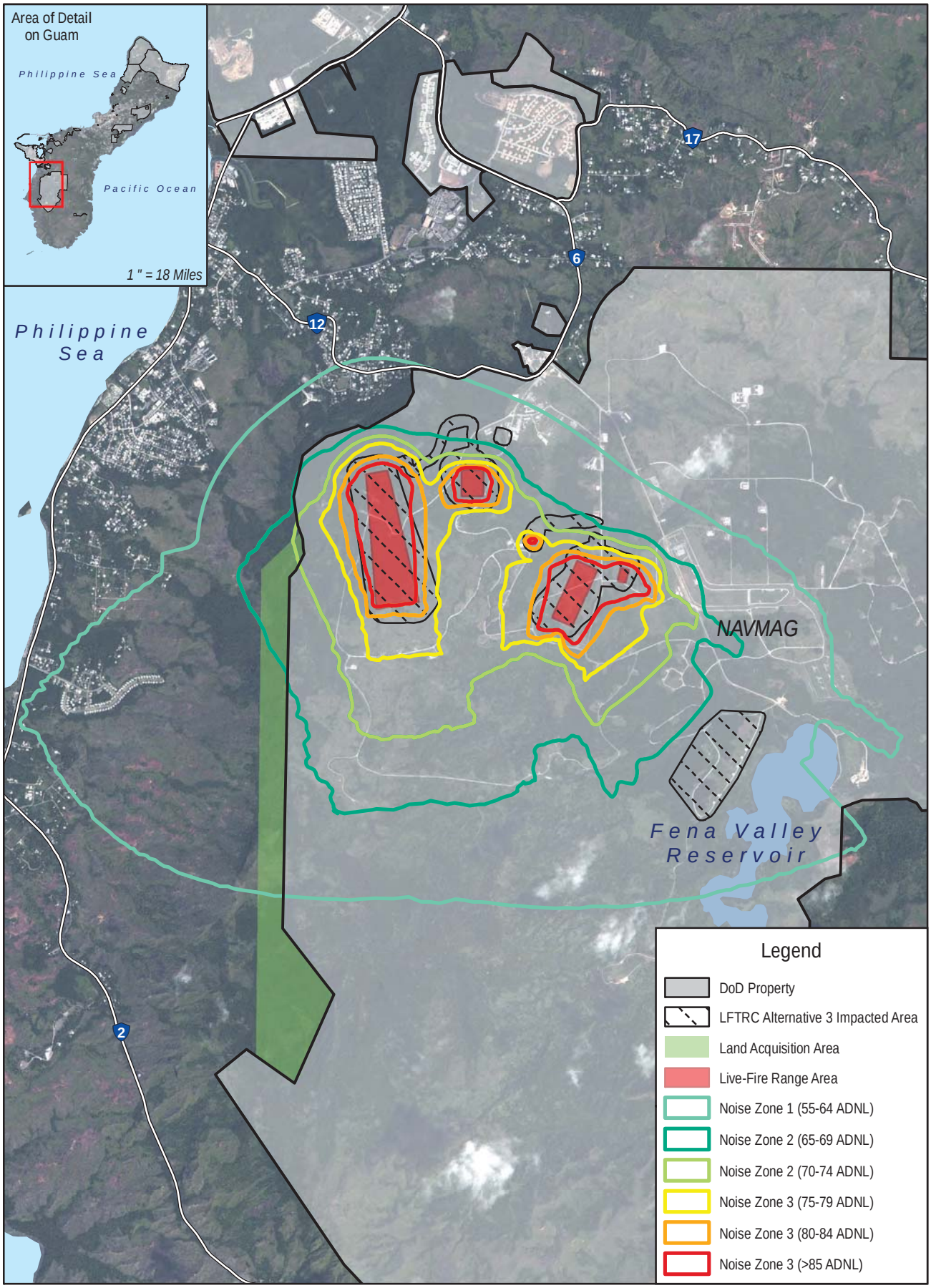


Figure 5.3.4-1
Small Arms ADNL Noise Zones for
NAVMAG (North/South) LFTRC Alternative 3

Under Alternative 3, no people would be impacted by Zone 2 or 3 noise levels because there are no residences within these zones. There would be no direct impacts due to live-fire training noise under this alternative because there would be no populated residential areas affected and none of the noise significance criteria stated in the Marine Corps Guidance memo for land use and noise exposure would be exceeded (Marine Corps 2005). There would be no direct or indirect impacts because no population would be affected, and none of the impact assessment criteria related to potential noise impacts would be exceeded. As described in Section 5.1.4.2, noise levels at the HG Range would remain within Andersen South and not impact any residences. In summary, there would be no residences/households affected by noise resulting from implementation of Alternative 3 and, consequently, no significant noise impacts would occur.

In comparison, Alternative 1 is the only LFTRC alternative that would potentially result in significant noise impacts, so the significance of Alternative 3 noise impacts is less than Alternative 1 and the same as Alternatives 2, 4 and 5.

5.3.5 Airspace

5.3.5.1 Affected Environment

The existing airspace conditions for Alternative 3 would be the same as described for Alternative 1 in Section 5.1.5.1. Detailed information on military and civilian air traffic associated with AAFB and Guam International Airport, respectively, is provided in the 2010 Final EIS (Volume 2, Chapter 7: Airspace, Section 7.1.2: Military Air Traffic, pages 7-8 to 7-10).

5.3.5.2 Environmental Consequences

Construction

No changes to airspace would be required during construction of the LFTRC under Alternative 3. Construction activities would not be expected to conflict or interfere with the use or management of existing airspace in the vicinity. Therefore, construction of the LFTRC under Alternative 3 would have no impact on airspace.

Operation

Figure 5.3.5-1 depicts the proposed Restricted Area associated with the LFTRC at NAVMAG (North/South). This SUA would be needed to contain the vertical hazard associated with the proposed live-fire training. Boundary coordinates for the proposed NAVMAG (North/South) Option A of R-7202 Guam would begin at:

- lat.13°22'56"N., long.144°39'54"E
- to lat.13°22'0"N., long.144°41'34"E
- to lat.13°19'54"N., long.144°41'54"E
- to lat.13°19'39"N., long.144°39'57"E
- to the point of beginning

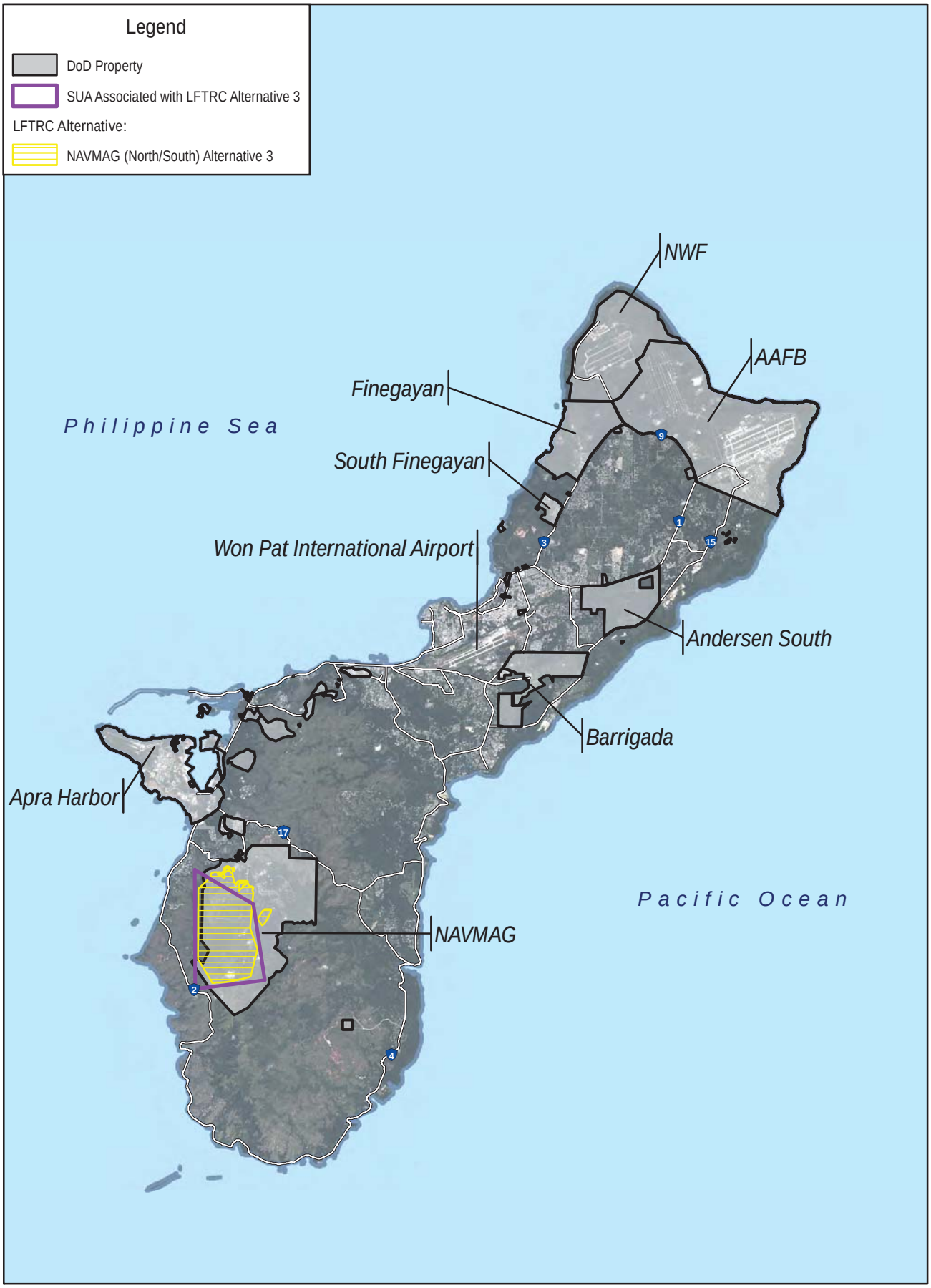


Figure 5.3.5-1
Proposed SUA Associated with LFTRC Alternative 3

Altitudes, times of use, and controlling and using agencies for this Restricted Area SUA would be the same as described in Section 5.1.5.2 for Route 15 LFTRC Alternative. The proposed CFA associated with the HG Range at Andersen South would be the same as described in Section 5.1.5.2 and depicted in Figure 5.1.5-4.

Section 3.5.3.1 identifies the potential impacts to airspace from implementation of the LFTRC alternatives. Given its location, Alternative 3 would directly impact arrivals into and departures out of Guam International Airport. The FAA stated in the preliminary Airspace Feasibility Assessment (FAA 2013) that Alternative 3 is not feasible. However, the FAA stated that "an assignment of 'not feasible' to a specific alternative is not a statement of infeasibility, but merely an assessment of the airspace in regard to the level of assumed impact" (FAA 2013).

Operational activities under Alternative 3 have the potential for significant direct long-term impacts to aviation due to the following:

- Guam International Airport Airspace and instrument approach procedures.
- Standard Instrument Departures and Standard Terminal Arrivals.
- IFR/VFR traffic flows.
- Terminal operations.

However, if this alternative is selected, long-term impacts and potential mitigation would be further studied through the DON/FAA/Air Force consultation process. The general types of potential mitigation measures that could be employed may include adjusting airspace per FAA coordination and/or adjusting LFTRC operation procedures if feasible. However, no specific potential mitigation measures are proposed at this time.

As detailed in Table 5.7-1, operational impacts under Alternative 3 would be the same as under Alternatives 1, 2, and 4. Operational impacts under this Alternative would be greater than impacts under Alternative 5.

5.3.6 Land and Submerged Land Use

5.3.6.1 Affected Environment

All LFTRC alternatives include a HG Range at Andersen South, the affected environment and impacts of which are described in Section 5.1.6.

The proposed Alternative 3 would be located almost entirely within the NAVMAG boundary, but does require some land acquisition (Figure 5.3.6-1). The acreages to be acquired are described in Section 2.5.4.7, Summary of LFTRC Alternatives, Table 2.5-3. No land acquisition is proposed for utility infrastructure or access roads. No submerged land would be affected.

The primary existing land use for NAVMAG is as described in Section 5.2.6. The LFTRC would require relocation of existing NAVMAG munitions storage facilities within NAVMAG.

All of the land proposed for acquisition is undeveloped and in its natural state (Appendix D SIAS; Figure 5.3-14, Table 5.3-3).

There are no land use plans for the community around the NAVMAG area of Guam. The GBSP land classification for the proposed acquisition area is Agriculture (see Figure 3.6.1-2). No current agricultural use was identified in the aerial photographs.

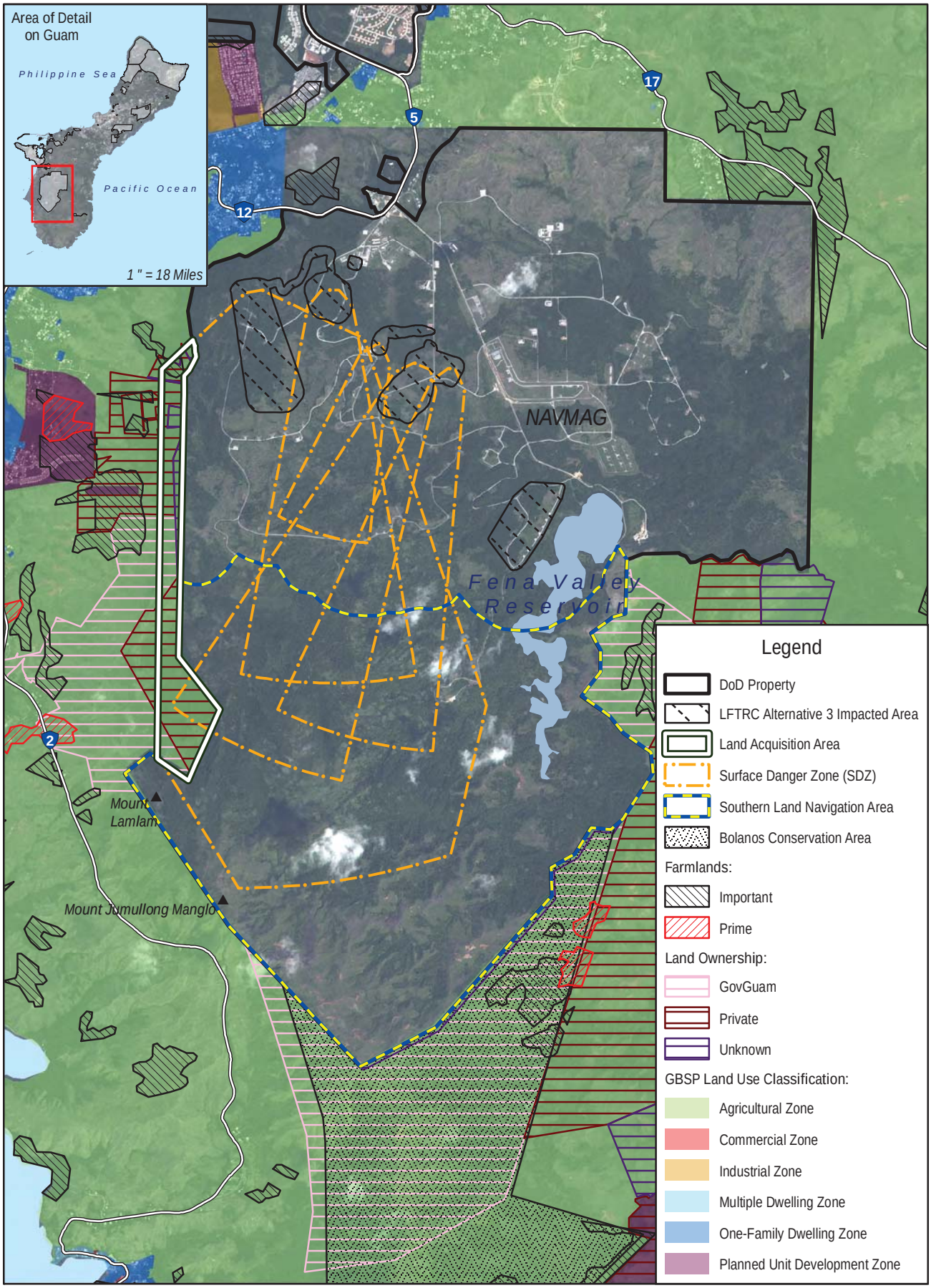


Figure 5.3.6-1
Land Use in the Vicinity of
NAVMAG (North/South) LFTRC Alternative 3

Adjacent land uses to the Alternative 3 impacted area are other NAVMAG land uses and non-federal lands that are classified by GBSP as Agriculture (see Figure 3.6.1-2).

Mount Lamlam and Mount Jumullong Manglo were identified west of the SDZs, but not adjacent (see Figure 5.3.6-1).

No human sensitive noise receptors were identified adjacent to Alternative 3, but Santa Rita Village is located north of the ranges.

5.3.6.2 Environmental Consequences

Land use impacts are addressed in this section. Land ownership impacts are addressed in Section 5.3.15, Socioeconomics and General Services.

Construction

As previously discussed in Chapter 3, Section 3.6.3.1, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource under any of the alternatives.

Operation

Potential impacts on Fena Valley Reservoir and water supply are addressed in Section 5.3.2.2, Water Resources. The wellhead protection areas would not be affected. LFTRC land use would be compatible with the existing military NAVMAG land use, except the use of the southern land navigation area would be discontinued and some magazines would need to be relocated. Any land use incompatibility issues related to the military mission within NAVMAG would be resolved through application of installation master planning guidelines outlined in UFC 2-100-01. Therefore, direct long-term land use impacts to NAVMAG would be less than significant.

No direct or indirect significant impact to existing land use or GBSP classification of Agricultural land use was identified within or adjacent to the land acquisition area. No USDA-designated prime farmland was identified. Less than 1% of the total Guam USDA-designated important farmland was identified in the acquisition area. This is considered a less than significant indirect long-term impact because it is not currently in agricultural use and there are other prime and important farmlands available for agricultural use. The acquired area would largely remain as open space.

Land use impacts related to other resource areas are covered under various sections of this SEIS, such as socioeconomic, recreational, water or noise. As addressed under Cultural Resources (Section 5.3.10) and Recreational Resources (Section 5.3.7), public access to Mount Lamlam and Mount Jumullong Manglo would not be impacted. The public would be restricted from entering the acquired lands. However, no educational, cultural or recreational sites were identified that would be affected by the restrictions. There would be no long-term impact related to access.

The proposed Alternative 3 would be compatible with the surrounding vacant land use. Zone 3 contours would not extend off-base. Zone 2 noise contours would extend beyond the proposed installation boundary, as described in Section 5.3.4.2, Noise and shown on Figure 5.3.4-1. However, no existing or planned residential land uses (or other sensitive receptors like schools or medical facilities) were identified within the Zone 2 contour. The acquisition area is designated for Agriculture, which is a compatible use within the Zone 2 noise contour. No impact on land use is anticipated.

Due to the lack of impacts to land use resources, Alternative 3 would have the least impact compared to all of the other LFTRC alternatives.

5.3.7 Recreational Resources

5.3.7.1 Affected Environment

Recreational resources within or adjacent to Alternative 3 are the same as those discussed in Section 5.2.7 for Alternative 2.

5.3.7.2 Environmental Consequences

As discussed in the 2010 Final EIS, access to, and use of, recreational resources at NAVMAG is restricted to installation personnel and guests (Volume 2, Section 9.1.5.1: Naval Munitions Site, Table 9.1-7: Recreational Resources on Naval Munitions Site and Public Access, page 9-14). While the nature of the potential proposed uses at or near NAVMAG has changed from the 2010 Final EIS, the potential impacts or lack of impacts remains the same. In the North-South alternatives, only a small portion of the SDZ extends outside NAVMAG property and there are no recreational resources that would be impacted by use of this area for LFTRC activities.

Construction

During construction activities, the short-term increase of construction-related vehicles on roads may cause delays to persons accessing recreational areas. Although staged construction equipment would not obstruct access to, or the use of, recreational resources, inconveniences to resource seekers (e.g., potential detours, longer waits, and other similar nuisances) would result. However, construction of Alternative 3 would not substantially reduce recreational opportunities, cause substantial conflicts between recreational users, or cause substantial deterioration of recreational resources. Therefore, short-term less than significant direct impacts to recreational resources would be anticipated.

Operation

Portions of SDZs are proposed outside NAVMAG property and to the east. These parcels would need to be acquired and would become federally owned property. Therefore, access to the public would be limited. In addition to access restrictions, there are potential indirect impacts from firing range noise, which could lessen visitor enjoyment of publicly accessible recreational resources in the area of the LFTRC. However, direct and indirect long-term impacts would be less than significant for the following reasons:

- The 2010 Final EIS states that the impacts are less than significant at the NAVMAG site. Even though the current East/West and L-Shaped NAVMAG LFTRC alternatives extend eastward from NAVMAG and would require land acquisition, there are no identified recreational resources in those areas that would be directly or indirectly affected by land acquisition.
- The construction of the access road for the East/West and L-Shaped NAVMAG LFTRC alternatives would make access to the area easier for the public during those times the ranges are not in operation.

Known recreational resources in the area (primarily Talofofo Falls) would not be impacted by noise during training.

5.3.8 Terrestrial Biological Resources

5.3.8.1 Affected Environment

Vegetation Communities

Figure 5.3.8-1 depicts the vegetation communities within NAVMAG associated with the proposed Alternative 3. The vegetation communities were mapped based on the following sources:

- USFS (2006) - island-wide coarse-scale mapping used as the starting point.
- Field surveys conducted in 2012 (NAVFAC Pacific 2013a) in notional range areas for more fine-scale mapping (some range locations were subsequently revised).
- COMNAV Marianas (2001) - *Merrilliodendron* forest locations.

Vegetation types are described in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.1.1: Vegetation Communities, pages 10-1 to 10-6). NAVMAG contains some of Guam's most remote, inaccessible terrestrial habitat and diverse vegetation communities. Portions of the western part of the action area consist of rugged limestone terrain of sharp pinnacles, towers and narrow fissures that supports a relatively pristine primary limestone vegetation community. For additional description of vegetation communities within NAVMAG, see the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.5.3: pages 10-76 to 10-77).

Terrestrial Conservation Areas

The majority of NAVMAG, including the impacted areas (i.e., physical disturbance for range footprints) of the Alternative 3 action area, is within established Overlay Refuge (see Figure 5.2.8-2). Additional information on Overlay Refuge lands is provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.1.3: Special-Status Species, pages 10-8 to 10-11).

Wildlife - Native Species

The only native migratory bird species observed in project-specific studies in the proposed Alternative 3 action area on NAVMAG were the yellow bittern and fairy tern (NAVFAC Pacific 2010, 2013a). General observations of migratory birds in southern Guam from the National Audubon Society's Christmas Bird Counts (National Audubon Society 2013) are described in Section 5.2.8.1.

During surveys conducted for this SEIS, three native reptile species (in addition to two Guam-listed species, discussed below) were observed within the forested areas of the proposed Alternative 3 action area: Pacific blue-tailed skink, mourning gecko, and mutilating gecko (NAVFAC Pacific 2013a).

The Talisay and Bonya rivers that drain into Fena Reservoir are present in the Alternative 3 action area. As noted in the 2010 Final EIS, there is limited information for Guam's freshwater ecosystems and it is not specific to the lands in this alternative (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.5.3: Naval Munitions Site - Freshwater Invertebrates and Fish, pages 10-77 to 10-78). However, relevant and applicable studies for the NAVMAG area were summarized in the 2010 Final EIS; no new information since the 2010 Final EIS is available.

Additional information on native wildlife species occurring within the NAVMAG is provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.5.3: Naval Munitions Site, page 10-77).

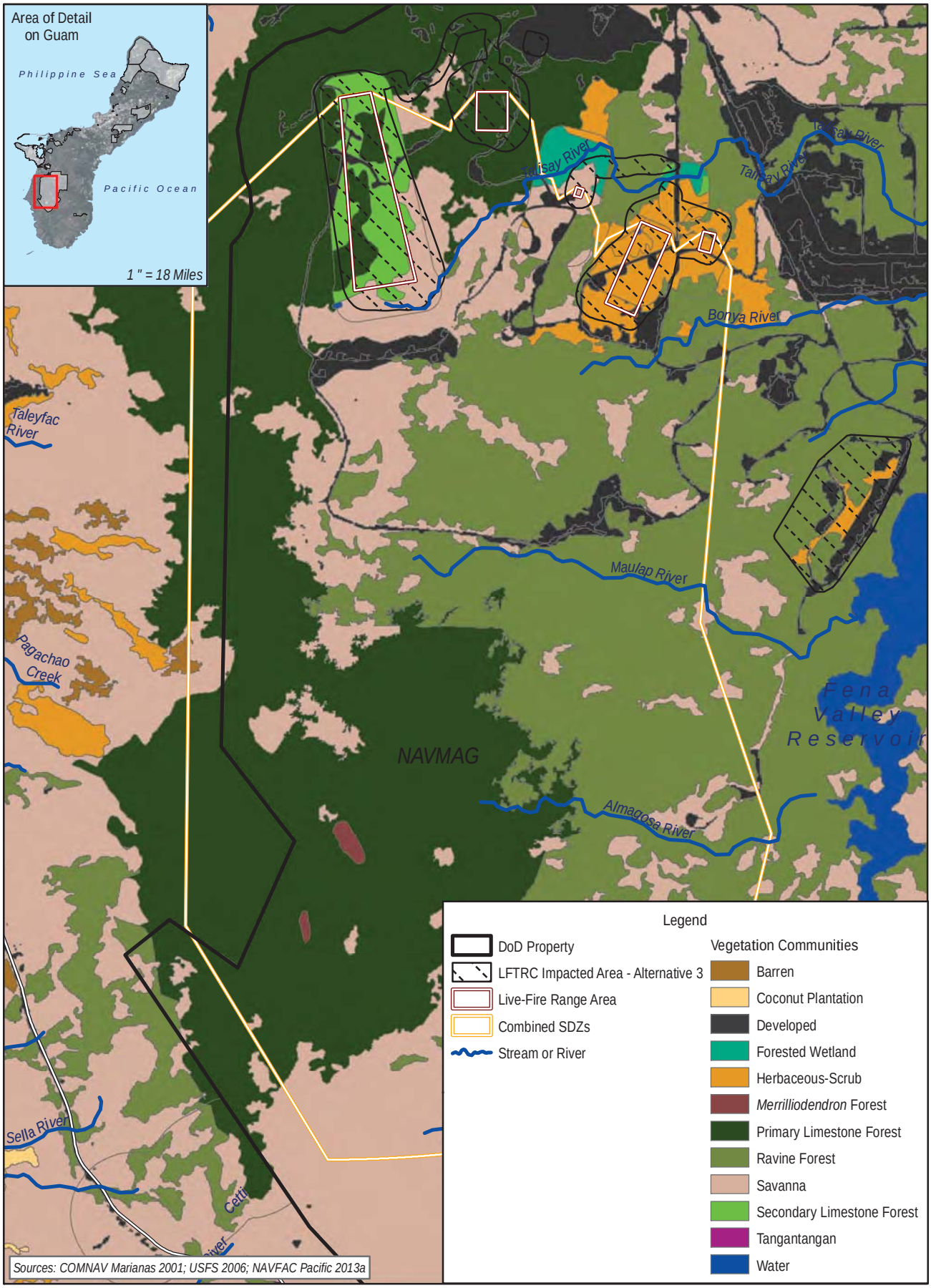


Figure 5.3.8-1
Vegetation Communities -
NAVMAG (North/South) LFTRC Alternative

Surveys conducted in 2009, 2010, 2012 and 2013 for the 2010 Final EIS and this SEIS observed a number of non-native species within NAVMAG. Non-native bird species observed within the Alternative 3 action area included the island collared dove, black drongo, and black francolin. Four non-native reptile and four amphibian species were found within the forested areas of the NAVMAG: curious skink, house gecko, brown treesnake, monitor lizard, marine toad, greenhouse frog, eastern dwarf tree frog, and Gunther's Amoy frog (NAVFAC Pacific 2010, 2013a).

Additional information on other non-native species at NAVMAG, including Asiatic water buffalo (or carabao), Philippine deer, feral pigs, brown treesnake, and freshwater invertebrates and fish, is provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.5.3: Naval Munitions Site, pages 10-78 to 10-79).

Special-Status Species: Federal ESA-Listed and Proposed Species

Two ESA-listed (Mariana fruit bat and Mariana common moorhen) and three proposed species (Mariana eight-spot butterfly, *Tabernaemontana rotensis*, and *Cycas micronesica*) occur within or in the vicinity of the proposed Alternative 3 ranges (Table 5.3.8-1 and Figure 5.2.8-3). Although "suitable habitat" for special-status species is present within the Alternative 3 project areas, the brown treesnake, the primary factor in the extirpation of special-status wildlife species on Guam and one of the largest obstacles to achieving recovery of special-status species, is still considered abundant and widespread on Guam. Until brown treesnakes are suppressed or removed from at least targeted areas on Guam, the habitat is not in a suitable condition to support the survival of special-status species due to current snake abundance on Guam (e.g., Guam Micronesian kingfisher, Guam rail, Mariana crow) (USFWS 2010a).

In addition to the discussion below, additional information for individual species at NAVMAG is provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.5.3: Naval Munitions Site, ESA-listed and Candidate Species, pages 10-79 to 10-84).

MARIANA FRUIT BAT. After 1996, an estimated 5-20 individual Mariana fruit bats were thought to occur within the NAVMAG/Upper Talofofo Watershed, and were assumed to be full time residents of the area, rather than migrants from the main Pati Point Colony on AAFB in northern Guam (Morton and Wiles 2002). USFWS (1996) speculated that disturbance associated with illegal hunting may have inhibited the establishment of a communal roost within NAVMAG. Currently, fruit bats are only occasionally observed at NAVMAG. During dawn and dusk observations on 42 different days between February and July 2008, only one bat was sighted along Almagosa Road (Brooke 2008). Surveys conducted in 2012 within the Alternative 3 action area for this SEIS observed solitary Mariana fruit bats within ravine forest on 6 separate days (see Figure 5.2.8-3) (NAVFAC Pacific 2013a). The sightings were generally within the same area and just north of the Brooke (2008) observation. Fruit bat recovery habitat is found within proposed project impacted areas and SDZs associated with Alternative 3 (see Figure 3.8.3-1).

MARIANA COMMON MOORHEN. The moorhen is a freshwater obligate species and inhabits emergent vegetation in freshwater marshes and ponds. As described in the 2010 Final EIS, the largest moorhen population was historically at Fena Reservoir. However, conditions in the reservoir have changed, causing moorhens to find more suitable habitat elsewhere. The decrease in suitable habitat seems to be a result of the decline of *Hydrilla verticillata*, a water plant used by moorhens as a nesting substrate (JRM 2013). The current population on Guam is estimated at 100-150 birds (USFWS 2012b).

Surveys in 2012 within the Alternative 3 action area documented moorhens on two ponds (see Figure 5.2.8-3). A single moorhen was observed on 2 separate days on a pond in the eastern portion of the action area within the northwest corner of the proposed KD Rifle Range (NAVFAC Pacific 2013a). A single

moorhen was also observed on 1 day on a pond located in the western portion of the proposed Alternative 3 ranges and just southwest of the range area associated with the proposed MPMG Range.

Table 5.3.8-1. Distribution of Special-Status Species within the Alternative 3 Action Area

Name	*Status**		*Habitat*	*Known to Occur*	*Comments*
	ESA	*Guam*			
Mammals					
Mariana fruit bat[b, c, d, e, h, i, k, m, q, r]	T	E	Limestone forest, ravine forest, coastal forest, and coconut plantations.	Yes	2008 and 2012 surveys: observations of single individuals; recovery habitat present.
Birds					
Mariana common moorhen[c, d, f, h, m, q]	E	E	Freshwater wetlands.	Yes	2012 surveys: observed in two ponds in action area and present at Fena Reservoir.
Mariana swiftlet[c, d, h, i, q]	E	E	Nests in caves; feeds over savannah and ravine forest.	No	2008, 2009, and 2012 surveys: not observed; nest/ roost caves 1 mile (1.6 km) to east.
Mariana crow[a, d, h, m, q, r]	E	E	All forests with a preference for native limestone forest.	No	Extirpated from Guam – last seen in southern Guam in the mid-1960s; recovery habitat present.
Guam Micronesian kingfisher[a, d, h, j, m, q, r]	E	E	Forest and scrub with a preference for native limestone forest.	No	Extirpated from the wild on Guam by 1985; last seen in southern Guam in the 1970s; recovery habitat present.
Guam rail[a, d, h, l, n, p, q, r]	E	E	Secondary habitats, some use of savanna and limestone forests.	No	Extirpated from the wild on Guam by 1988; last seen in southern Guam in the 1970s; recovery habitat present.
Reptiles					
Slevin's skink[i, t]	PE	E	Mid-elevation closed humid and montane forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Pacific slender-toed gecko[c, d, h]	-	E	Forest edge.	Yes	2012 surveys: observed in impacted areas and SDZs.
Moth skink[c, d, h, i]	-	E	Forest areas with large tree trunks.	Yes	2008, 2009, and 2012 surveys: not observed in impacted areas; observed only within SDZs.
Invertebrates					
Mariana eight-spot butterfly[i, n, t]	PE	-	Limestone forest with host plants.	Yes	2012 surveys: host plants documented within impacted areas and adult within SDZs.
Mariana wandering butterfly[i, s, t]	PE	-	Larvae feed on one known host plant species found in native limestone forest habitat.	No	Has not been seen on Guam since 1979 and considered extirpated; host plants not observed during 2012 surveys of impacted areas.
Guam tree snail[c, d, g, h, i, t]	PE	E	Cool shaded forested areas with high humidity.	No	2009 and 2012 surveys: not observed in impacted areas.
Humped tree snail[c, d, g, h, i, t]					
Fragile tree snail[c, d, g, h, i, o, t]					

Name	***Status****		***Habitat***	***Known to Occur***	***Comments***
	ESA	*Guam*			
Plants					
Serianthes tree[d, h, m, q, r]	E	E	Limestone and ravine forests.	No	2008, 2009, and 2012 surveys: not observed in impacted areas; recovery habitat present.
Heritiera longipetiolata[d, h, q, t]	PE	E	Limestone forest.	Yes	2008, 2009, and 2012 surveys: not observed in impacted areas; observed only within SDZs.
Cyathea lunulata[d, h, q]	-	E	Wet ravines at the boundary with savanna in southern Guam.	No	2008, 2009, and 2012 surveys: not observed in impacted areas or SDZs.
Cycas micronesica[d, q, t]	PE	SOGCN	Limestone and ravine forests, and savanna summits.	Yes	2012 surveys: observed within impacted areas.
Merrilliodendron megacarpum[d, q]	-	SOGCN	Native limestone forest.	Yes	
Tabernaemontana rotensis[d, q, t]	PT				
Bulbophyllum guamense[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Eugenia bryanii[i, t]	PE	-	Windy exposed coastal clifflines in lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Maesa walkeri[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Nervilia jacksoniae[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Psychotria malaspinae[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Solanum guamense[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Tinospora homosepala[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Tuberolabium guamense[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas; observed on the NAVMAG during surveys for 2010 EIS but outside the current proposed impacted areas.
Hedyotis megalantha[i, t]	PE	-	Savanna	No	NR; not observed in 2012 surveys in the impacted areas.
Dendrobium guamense[i, t]	PE	-	Limestone forests	No	NR; not observed in 2012 surveys in the impacted areas.
Phyllanthus saffordii[i, t]	PE	-	Savanna	No	NR; not observed in 2012 surveys in the impacted areas.

Legend: *E = endangered, PE = proposed endangered, PT = proposed threatened, T = threatened.
Sources: [a]Jenkins 1983; [b]USFWS 1990; [c]COMNAV Marianas 2001; [d]GDAWR 2006; [e]Brooke 2008; [f]Brooke and Grimm 2008; [g]Smith *et al.* 2008; [h]GovGuam 2009; [i]NAVFAC Pacific 2013a; [j]USFWS 2008b; [k]USFWS 2009a; [l]USFWS 2009b; [m]USFWS 2011; [n]USFWS 2012a; [o]USFWS 2012c; [p]BirdLife International 2013; [q]JRM 2013; [r]USFWS 2010b; [s]USFWS 2012d; [t]USFWS 2014a, 2014b.

MARIANA SWIFTLET. Swiftlets nest and roost in caves and leave the caves during the day to forage over a wide variety of terrain and vegetation, favoring ridge crests and open grassy areas where they capture small insects while flying (USFWS 1991). There are only three known nesting/roosting caves (Mahlac, Fachi, and Maemong) on Guam for this species and they are located in the northern NAVMAG approximately 1 mile (1.6 km) east of the proposed Alternative 3 action area (see Figure 5.2.8-3). The

number of swiftlets at Mahlac cave fluctuates around 1,000, while the number at Maemong cave from 2010 to 2012 ranged between 40 and 126, and at Fachi cave have fluctuated between a low of 3 (2011) and a high of 172 (2009) (Brindock 2012). Although potential foraging habitat occurs within the action area, no Mariana swiftlets were observed during 2008, 2009, and 2012 surveys within the Alternative 3 action area (NAVFAC Pacific 2010, 2013a).

MARIANA CROW. The Mariana crow was last observed in southern Guam in the mid-1960s (USFWS 2005). Since 2009, the population on Guam consisted only of two males on AAFB, occurring primarily within the MSA (USFWS 2009c). However, as of 2012, the Mariana crow is considered extirpated in the wild on Guam (Personal communication via letter from USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, HI regarding the DON NOI for Proposed Placement of LFTRC on Guam NWR; December 7, 2012). The closest population of crows is on the island of Rota, approximately 56 miles (90 km) north of Guam. Crows in northern Guam used primary limestone forest for nesting, with nests exclusively in native trees. They have been observed foraging in both primary and secondary limestone forests and tangantangan (USFWS 2005). Crow recovery habitat is found within proposed project impacted areas and SDZs associated with Alternative 3 (see Figure 3.8.3-1).

GUAM RAIL. The Guam rail was last seen in southern Guam in the 1970s, and was extirpated in the wild by 1985. It exists primarily in captivity on Guam and in mainland zoos. Experimental populations of Guam rails were introduced onto Rota, CNMI in 1989 and onto Cocos Island, off the southern coast of Guam, in 2011 (USFWS 2009b; BirdLife International 2013). The Guam rail prefers edge habitats, especially grassy or secondary vegetation areas which provide good cover; mature forest is deemed only marginal for the Guam rail (USFWS 2009b). Rail recovery habitat is found within proposed project impacted areas associated with Alternative 3 (see Figure 3.8.3-2).

GUAM MICRONESIAN KINGFISHER. The Guam Micronesian kingfisher was last seen in southern Guam in the 1970s, and was extirpated in the wild by 1988. It is now found only in captivity on Guam and at mainland zoos (USFWS 2008). Kingfishers utilized a wide variety of habitats including primary and secondary limestone forest, strand forest, coconut forest, edge habitats, and forest openings, but mature forests with tree cavities suitable for nesting may be an important requirement for kingfisher reproduction (USFWS 2008). Kingfisher recovery habitat is found within proposed project impacted areas and SDZs associated with Alternative 3 (see Figure 3.8.3-1).

SLEVIN'S SKINK. Originally found on Guam, Cocos Island, Rota, Tinian, Guguan, Alamagan, Asuncion, and Maug, it is now limited to Cocos Island, Sarigan, Guguan, Alamagan, Pagan, and Asuncion. Slevin's skink has not been recorded on Guam since 1945 and is believed to be extirpated from Guam; it is now known to occur only on Cocos Island (an atoll south of Guam) (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 3 (USFWS 2014b). Therefore, as Slevin's skink is not found within the impacted areas of Alternative 3, this species is not addressed further.

MARIANA EIGHT-SPOT BUTTERFLY. Although the Mariana eight-spot butterfly (adults, larvae, or eggs) was not observed during 2012 surveys within the action area, one large patch and numerous small patches of the host plant *Procris pedunculata* were observed and mapped within the proposed MPMG Range footprint or 328-foot (100-m) buffers (see Figure 5.2.8-3) (NAVFAC Pacific 2013a).

TREE SNAILS. The three proposed endangered tree snail species (Guam tree snail, humped tree snail, and fragile tree snail) were not observed during field surveys conducted within the proposed Alternative 3 action area in 2009 in support of the 2010 Final EIS and in 2012 in support of this SEIS (NAVFAC Pacific 2010, 2013a, 2013b). In 2008, the Guam tree snail was observed 700 feet (210 m) northwest of the proposed magazine relocation area and approximately 3,000 feet (914 m) southeast of the Non-standard

Small Arms range area (see Figure 5.2.8-3) (Smith *et al.* 2008), outside of the Alternative 3 impacted area and SDZ. Therefore, as the tree snail species are not found within the Alternative 3 impacted areas, these species are not addressed further.

SERIANTHES TREE. The endangered *Serianthes* tree was not observed during field surveys conducted within the proposed Alternative 3 action area in 2009 in support of the 2010 Final EIS and in 2012 in support of this SEIS (NAVFAC Pacific 2010, 2013a, 2013b). The only known location on Guam of the *Serianthes* tree is on AAFB, more than 20 miles (32 km) north of the NAVMAG. However, *Serianthes* recovery habitat is found within proposed project impacted areas and SDZs associated with Alternative 3 (see Figure 3.8.3-2).

TABERNAEMONTANA ROTENSIS AND *CYCAS MICRONESICA*. During 2012 surveys, one area of *C. micronesica* and one specimen of *T. rotensis* were observed within the impacted area of the proposed MPMG Range (see Figure 5.2.8-3). The cycad is found in limestone forests throughout Guam and is proposed as an endangered species under the ESA because of the Asian cycad scale insect that is devastating the species (USFWS 2014a).

HERITIERA LONGIPETIOLATA. This endemic tree is found in crevices of rough limestone in primary limestone forest (USFWS 2014a). Field surveys for the 2010 Final EIS (NAVFAC Pacific 2010) and in 2012 for this SEIS (NAVFAC Pacific 2013a) did not find *H. longipetiolata* within the proposed range areas under Alternative 3. Two locations of *H. longipetiolata* are known from the southern portion of the proposed SDZ and one individual is recorded just south of the proposed munitions magazine relocation area (see Figure 5.2.8-3). As *H. longipetiolata* has not been observed within the proposed impacted areas of Alternative 3, this species is not addressed further.

BULBOPHYLLUM GUAMENSE. An epiphyte in the orchid family, this species occurs in mat-like formations on tree branches of coastal lowland/limestone forests. Currently, there are 8 known occurrences on Guam totaling fewer than 250 individuals. There is one occurrence in the northern NAVMAG east of the main gate (Figure 5.2.8-3) (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 3 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *B. guamense* is not found within the impacted areas of Alternative 3, this species is not addressed further.

EUGENIA BRYANII. A perennial shrub in the myrtle family, the species is known only from the island of Guam. Historically, *E. bryanii* is known from windy exposed coastal clifflines and along the Pigua River, in lowland/limestone forests. Currently, *E. bryanii* is known from 6 occurrences totaling fewer than 420 individuals (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 3 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *E. bryanii* is not found within the impacted areas of Alternative 3, this species is not addressed further.

MAESA WALKERI. A shrub or small tree in the primrose family typically found in limestone forests, this species is known from only two individuals on Guam, one of which is located along the southwestern border of the NAVMAG (Figure 5.2.8-3) (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative 3 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *M. walkeri* is not found within the impacted areas of Alternative 3, this species is not addressed further.

NERVILIA JACKSONIAE. A small herb in the orchid family, this species is found in lowland/limestone forests. On Guam, *N. jacksoniae* is known from two occurrences totaling fewer than 200 individuals (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 3

(NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *N. jacksoniae* is not found within the impacted areas of Alternative 3, this species is not addressed further.

PSYCHOTRIA MALASPINAE. A shrub or small tree in the coffee family, this species is found in lowland/limestone forests. Currently, *P. malaspinae* is known from 5 occurrences. None of these individuals have been observed within the last 5 years (USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative 3 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *P. malaspinae* is not found within the impacted areas of Alternative 3, this species is not addressed further.

SOLANUM GUAMENSE. A small shrub in the nightshade family that occurs within limestone forests. Currently, *S. guamense* is known from a single occurrence of one individual on Guam (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 3 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *S. guamense* is not found within the impacted areas of Alternative 3, this species is not addressed further.

TINOSPORA HOMOSEPALA. A vine in the moonseed family found in limestone forests. Currently, *T. homosepala* is known from 3 occurrences totaling approximately 300 individuals (USFWS 2014). There are no records of the species within the impacted areas of Alternative 3 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *T. homosepala* is not found within the impacted areas of Alternative 3, this species is not addressed further.

TUBEROLABIUM GUAMENSE. An epiphyte in the orchid family found in limestone forests. Currently, *T. guamense* is known from 3 occurrences on Guam: 2 occurrences within the NAVMAG (1 occurrence in the forest ecosystem of the Mt. Almagosa cliffline and 1 south of the swiftlet caves) (see Figure 5.2.8-3) and 1 at Finegayan (NAVFAC Pacific 2010; USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative 3 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *T. guamense* is not found within the impacted areas of Alternative 3, this species is not addressed further.

DENDROBIUM GUAMENSE. An epiphyte in the orchid family, the species occurs within lowland/limestone forests and savanna. On Guam, there are 4 occurrences totaling fewer than 250 individuals (USFWS 2014a). There is one known occurrence within the NAVMAG within the vicinity of Almagosa Springs (Figure 5.2.8-3). There are no records of the species within the impacted areas of Alternative 3 (USFWS 2014b). Therefore, as *D. guamense* is not found within the impacted areas of Alternative 3, this species is not addressed further.

HEDYOTIS MEGALANTHA. A perennial herb in the coffee family, this species occurs in savanna areas in southern Guam. Currently, *H. megalantha* is known from one large scattered occurrence totaling fewer than 1,000 individuals on southern Guam, between Mt. Alutom and Tarzan Falls. This species typically occurs as lone individuals rather than in patches or groups (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 3 (USFWS 2014b). Therefore, as *H. megalantha* is not found within the impacted areas of Alternative 3, this species is not addressed further.

PHYLLANTHUS SAFFORDII. This woody shrub is currently known from four scattered occurrences on southern Guam within savanna areas: Mt. Alutom, Piti Hills, Nimitz Hill "War in the Pacific Lookout," and near the Cetti Bay Watershed (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 3 (USFWS 2014b). Therefore, as *P. saffordii* is not found within the impacted areas of Alternative 3, this species is not addressed further.

Special-Status Species: Guam-Listed Species and SOGCN

One Guam-listed species (Pacific slender-toed gecko) occurs within the impacted areas and SDZs of the proposed Alternative 3 (see Table 5.3.8-1). Those species that are also listed under the federal ESA were discussed above.

PACIFIC SLENDER-TOED GECKO. Field surveys in 2012 documented the Pacific slender-toed gecko within the impacted area of the proposed MPMG Range within the western portion of the Alternative 3 action area (NAVFAC Pacific 2013a) (see Figure 5.2.8-3). Surveys conducted in 2008 and 2009 in support of the 2010 Final EIS, and within the Alternative 3 action area, also observed the Pacific slender-toed gecko within the proposed SDZ associated with Alternative 3 (NAVFAC Pacific 2010).

MOTH SKINK. The moth skink was not observed during surveys conducted in 2012 in support of this SEIS within the impacted areas under Alternative 3 (NAVFAC Pacific 2013a). Surveys conducted in 2008 and 2009 in support of the 2010 Final EIS, and within the Alternative 3 action area, observed the moth skink only within the proposed SDZ associated with Alternative 3 (see Figure 5.2.8-4) (NAVFAC Pacific 2010). As the moth skink has only been observed within the proposed SDZ of Alternative 3, and there would be no ground-disturbing activities within the SDZ, this species is not addressed further.

CYATHEA LUNULATA. Field surveys for the 2010 Final EIS (NAVFAC Pacific 2010) and in 2012 for this SEIS (NAVFAC Pacific 2013a) did not find the tree fern *C. lunulata* within the proposed range areas under Alternative 3. As the tree fern has not been observed within the impacted areas associated with Alternative 3, this species is not addressed further.

MERRILLIODENDRON MEGACARPUM. During 2012 surveys, several small patches of *M. megacarpum* were observed within the impacted area of the proposed MPMG Range (see Figure 5.2.8-3). *M. megacarpum* is considered an SOGCN because of its rarity and potential threats from ungulate damage, typhoons, development, and insect infestation (GDAWR 2006). *M. megacarpum* is also present in large patches within primary limestone forest in the west-central area of the SDZ (see Figure 5.2.8-3).

5.3.8.2 Environmental Consequences

Construction

Vegetation. Construction activities under Alternative 3 would remove 105 acres (42 ha) of primary limestone forest, 64 acres (26 ha) of secondary limestone forest, 58 acres (23 ha) of ravine forest, 72 acres (29 ha) of herbaceous scrub, 38 acres (15 ha) of savanna, 52 acres (22 ha) of developed areas, and 3.3 acres (1.3 ha) of forested wetlands (Table 5.3.8-2). Based on surveys conducted in 2012 in the proposed range areas, the ravine forest community is significantly degraded in many areas by invasion of non-native woody plant species including *Vitex* and betelnut palm, and heavy infestation by herbaceous non-native invasive plants (NAVFAC Pacific 2013a). Impacts to vegetation from construction of the proposed HG Range at Andersen South were discussed in Section 5.1.8.2 and were found to be less than significant. Refer to Section 5.3.2.2, *Water Resources*, for a discussion of impacts to wetlands.

Table 5.3.8-2. Direct Construction-Related Impacts to Vegetation Communities with Implementation of LFTRC Alternative 3

Project Component	*Vegetation Community (acres [ha])*							
	PLF	***SLF***	***RF***	***Sav***	***FW***	***HS***	***Dev***	***Total***
Range Areas and Associated Features	85.7 (34.7)	63.7 (25.8)	13.0 (5.3)	38.3 (15.5)	3.3 (1.3)	60.7 (24.6)	26.2 (10.6)	**290.9 (117.7)**
Magazine Relocation	0	0	44.7 (18.1)	0	0	9.8 (4.0)	24.4 (9.9)	**78.9 (31.9)**
HG Range (at Andersen South)	19.4 (7.9)	0	0	0	0	1.8 (0.7)	1.8 (0.7)	**23.0 (9.3)**
Total	**105.1 (42.5)**	**63.7 (25.8)**	**57.7 (23.4)**	**38.3 (15.5)**	**3.3 (1.3)**	**72.3 (29.3)**	**52.4 (22.3)**	**392.8 (127.0)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; RF = ravine forest; Sav = savannah; FW = forested wetland; HS = herbaceous scrub; Dev = developed.

Native limestone forest, both primary and secondary, has been significantly reduced on Guam due to past and ongoing actions including extensive disturbance during and after WWII, widespread planting of non-native species; and impacts from non-native ungulates; development; fire; and deforestation. As stated in Section 3.8.1.1, limestone forests on Guam are important since they retain the functional ecological components of native forest that provide habitat for the majority of Guam's native species, including ESA-listed, ESA-proposed, and Guam-listed species, and Guam SOGCN, as well as maintaining water quality and reducing fire risk. Non-native forest communities (e.g., tangantangan, *Vitex*) significantly alter the forest structure, composition, and resilience to other disturbance processes and do not provide the conditions suitable for native flora and fauna species to persist (Morton *et al.* 2000; GDAWR 2006; Guam Department of Agriculture 2010; JRM 2013).

Of the 18,538 acres (7,502 ha) of primary and secondary limestone forest found on Guam, approximately 13,110 acres (5,305 ha) are found primarily within AAFB, Finegayan, and the NAVMAG (USFS 2006). Under Alternative 3, 169 acres (68 ha) of limestone forest and 58 acres (23 ha) of ravine forest would be removed (see Table 5.3.8-2). Ravine forest is also an important community type for native species in southern Guam. Therefore, given the importance of limestone and ravine forest habitats for native species and the continuing loss of native forests across Guam, the conversion of 227 acres (92 ha) of limestone and ravine forest on the NAVMAG to developed area would be a significant but mitigable impact to the regional vegetation community and its function.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on vegetation communities with implementation of Alternative 3. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the contractor education program.
- *Onsite Vegetation Waste Management Procedures.* See Section 4.1.8.2 under Construction, *Vegetation for a detailed description of the vegetation waste management procedures.*

- *DON Guam Landscaping Guidelines*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of landscaping guidelines.
- *LFTRC Range Berm Controls.* To manage stormwater runoff and control erosion, LFTRC range berms would contain native or non-invasive herbaceous vegetation and other engineering controls.
- *Contractor Plans and Specifications*. All construction would occur within the limits of construction shown in the project figures.

Potential Mitigation Measures

To mitigate for significant impacts to limestone forest, the DON proposes to implement forest enhancement on a minimum of 227 acres (92 ha) of limestone forest. Forest enhancement would include but is not limited to the following actions:

- Ungulate management consisting of exclusion fencing and active control (i.e. trapping, snaring, shooting) with the goal of eradication within the fenced areas.
- Non-native, invasive vegetation removal.
- Propagation, planting, and establishment of native species that are characteristic of native limestone forest habitats (e.g., *A. mariannensis, G. mariannae, F. prolixa, M. citrifolia, W. elliptica*).

The degradation and loss of primary limestone and other forest habitats resulting from ungulate damage and invasion by alien plant species has substantially diminished the extent of habitat for native species in the Mariana archipelago. The anticipated benefit of implementing these potential mitigation measures is improved habitat quality for native flora and fauna, including special-status species. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Terrestrial Conservation Areas. The only terrestrial conservation area within the impacted areas of Alternative 3 is Overlay Refuge. Overlay Refuge lands were established for the purpose of conserving and protecting ESA-listed species and other native flora and fauna, maintaining native ecosystems, and the conserving native biological diversity, recognizing that the primary purpose of lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force.

Approximately 276 acres (112 ha) of Overlay Refuge lands (Table 5.3.8-3), or 1.3% of the total Overlay Refuge lands on Guam, would be directly impacted under Alternative 3. This area overlaps with the vegetation communities discussed previously. The majority (139 acres [56 ha]) is comprised primarily of limestone forest (Table 5.3.8-3). Therefore, because proposed construction activities would convert 276 acres (112 ha) of Overlay Refuge lands to developed areas, this would be a significant loss to the conservation function of these lands and implementation of Alternative 3 would result in significant but mitigable impacts to terrestrial conservation areas.

Table 5.3.8-3. Impacts to Overlay Refuge with Implementation of LFTRC Alternative 3

Project Component	*Overlay Refuge (acres [ha])*							
	PLF	***SLF***	***HS***	***FW***	***RF***	***Sav***	***Dev***	***Total***
Range Areas and Associated Features	75.5 (30.6)	63.7 (25.8)	60.7 (24.6)	3.3 (1.3)	13.0 (5.3)	37.2 (15.1)	22.1 (8.9)	**275.5 (111.5)**
HG Range (at Andersen South)	0	0	0	0	0	0	0	**0**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; FW = forested wetland; RF = ravine forest; Sav = savannah; Dev = developed.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on terrestrial conservation areas with implementation of Alternative 3. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

The same BMPs discussed above under *Vegetation* would be implemented for terrestrial conservation areas.

Potential Mitigation Measures

To mitigate for significant impacts to terrestrial conservation areas, the DON would submit a proposal to CNO Energy and Environmental Readiness Division to designate an ERA on the NAVMAG to conserve native limestone forest in southern Guam which provides habitat for special-status species. The DON has defined an ERA as a physical area or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural, physical, and biological processes to prevail without human intervention. However, under unusual circumstances, deliberate manipulation (e.g., removal or control of invasive species) may be utilized to maintain the unique feature that the ERA was established to protect (NAVFAC 1996). The proposed NAVMAG ERA would encompass approximately 553 acres (234 ha). Although the proposed NAVMAG ERA is currently part of the Overlay Refuge, implementation of these potential mitigation measures would provide an increased level of protection by further ensuring this area is maintained in natural and near natural conditions and to have available such areas for research and scientific manipulation (NAVFAC 1996; NAVFAC Marianas 2010).

In addition, the DON proposes to submit a proposal to CNO Energy and Environmental Readiness Division to expand the existing Orote ERA by approximately 32 acres (13 ha) of terrestrial habitat. The Final Orote ERA Expansion proposal was completed FY 2013 and will be submitted for approval in 2014.

Wildlife - Native Species. Short-term construction noise may temporarily impact suitable habitat for native birds in the vicinity of the construction areas, but they would relocate to other areas of suitable habitat in the vicinity, and could return to the area following construction. Non-listed native reptiles are abundant throughout Guam and impacts to vegetation communities under Alternative 3 would result in less than significant impacts to non-listed native reptile populations. Implementation of Alternative 3 would not have a significant adverse effect on a population of any migratory bird species or other native wildlife species. Impacts to wildlife from the construction of the HG Range at Andersen South were discussed in Section 5.1.8.2 and impacts would be less than significant.

Therefore, as presented above, long-term, direct impacts to populations of native wildlife species would not result because these species are abundant in surrounding areas and could repopulate portions of suitable habitat within the affected area after construction. Therefore, direct impacts to native wildlife species would be less than significant with implementation of proposed construction activities associated with Alternative 3.

Proposed construction activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. To prevent the inadvertent spread of non-native species on Guam or to other locations off of Guam, the DON would implement standard biosecurity measures (e.g., HACCP, brown treesnake interdiction measures,

coconut rhinoceros beetle vegetation management procedures, and outreach/education) into construction protocols, procedures, and activities.

The following BMPs would be implemented to avoid and minimize potential direct, long-term impacts of proposed construction activities on native wildlife with implementation of Alternative 3.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

With implementation of these BMPs, including development of HACCP plans and ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species (e.g., coconut rhinoceros beetle), the potential for the introduction of new or spread of existing non-native species on Guam is substantially reduced. Therefore, there would be less than significant impacts to native wildlife species related to the potential introduction and establishment of non-native species with implementation of proposed construction activities associated with Alternative 3.

Damage of forested areas, particularly primary and secondary limestone forests, by non-native ungulates (i.e., deer and pigs) is a serious concern on Guam. Under Alternative 3, removal of large amounts of limestone forest currently used by ungulates would displace and concentrate ungulates into adjacent areas, resulting in even higher densities and potentially greater habitat damage. Potential impacts from changes in ungulate densities from construction projects within the same or similar habitat areas as proposed in this SEIS were addressed in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-115).

The implementation of the potential mitigation measures under the *Vegetation* section above would also benefit native wildlife species. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

Special-Status Species: Federal ESA-Listed and Proposed Species

Impacts to special-status species from the construction of the HG Range at Andersen South were discussed in Section 5.1.8.2 and were determined to be less than significant. The following discussion addresses those species that occur within the proposed ranges and SDZs under Alternative 3.

MARIANA FRUIT BAT. Approximately 223 acres (90 ha) of Mariana fruit bat recovery habitat would be removed due to proposed construction activities at NAVMAG under Alternative 3. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Additional potential direct temporary impacts to the Mariana fruit bat from construction activities are based on the distances from those activities that are likely to cause disturbance to this species (e.g., noise, human activity, lighting). The evaluation of fruit bat disturbance is based on the approach used by

USFWS in previous ESA section 7 formal consultations and associated BOs (e.g., USFWS 2006b, 2010). These distances are: roosting habitat within 492 feet (150 m) and foraging habitat within 328 feet (100 m) from the activity (Wiles, personal communication 2006 and Janeke, personal communication 2006, respectively, as cited in USFWS 2006b).

The species is currently limited to the few areas on Guam away from human activities and with suitable habitat, primarily on federal lands on the NAVMAG and AAFB (JRM *et al.* 2012a, 2012b; JRM 2013; A. Brooke, NAVFAC Marianas, personal communication). However, illegal hunting, loss and degradation of native forest, predation by the brown treesnake, and the increased extirpation risk owing to the high vulnerability of very small populations continue to limit the potential recovery of the species on Guam (USFWS 2010; JRM 2013). Based on the equilibrium/carrying capacity of snakes on Guam (Rodda and Savidge 2007), implementation of the proposed action is not expected to increase the likelihood of predation by the brown treesnake on Mariana fruit bats.

Although the loss of 223 acres (90 ha) of fruit bat recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, it would reduce the total number of bats that the island can support. Given this loss of recovery habitat and the critically low numbers of bats on Guam, there would be significant but mitigable impacts to the Mariana fruit bat.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on Mariana fruit bats with implementation of Alternative 3. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Pre-Construction Surveys*. Surveys would be completed within suitable fruit bat habitat 1 week prior to onset of construction activities following the USFWS-approved JRM protocol. If a fruit bat is present within 492 feet (150 m) of the project site, the work must be postponed until the bat has left the area.
- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all new roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

Potential Mitigation Measures

The same potential mitigation measures discussed previously under *Vegetation* (i.e., forest enhancement of 227 acres [92 ha] of limestone forest) would be applicable for the Mariana fruit bat and its recovery habitat. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana fruit bat. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

MARIANA SWIFTLET. Although the only swiftlet nest/roost caves are approximately 1 mile (1.6 km) east of the proposed LFTRC, surveys within the Alternative 3 action area in 2008, 2009, and 2012 did not observe any Mariana swiftlets within the area. Based on surveys for this SEIS as well as observations from other survey efforts, swiftlets appear to forage to the north, east and south of the caves (Morton and Amidon 1996; NAVFAC Pacific 2010, 2013a, 2013b; R. Spaulding, Cardno TEC, unpublished data). Swiftlets would continue to forage to the north, east and south of the nest/roost caves on the NAVMAG and the drainages of the Mahlac, Maagas, and Talofofo rivers (see Figure 5.2.8-3). The proposed construction activities would also not impact regional insect populations that are the prey base for the swiftlet. Although noise levels within the immediate vicinity of proposed construction activities would increase, they would be localized and temporary. Proposed construction activities would not impact the swiftlet nesting/roosting caves approximately 1 mile (1.6 km) east of the proposed ranges. Therefore, there would be less than significant impacts to the Mariana swiftlet with implementation of the proposed range construction activities under Alternative 3.

MARIANA CROW. The Mariana crow is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the crow is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the crow, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 3, impacts to the crow would be limited to recovery prospects. If crows are reintroduced and exposed to construction activities under Alternative 3, they may be disturbed (DON 2014).

Although the crow no longer occurs on Guam, approximately 230 acres (93 ha) of crow recovery habitat would be removed due to proposed construction activities at NAVMAG under Alternative 3. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Although this loss of crow recovery habitat on Guam would not preclude the recovery of the crow should it be reintroduced to Guam in the future, it would reduce the total number of crows that the island can support. If and when the crow is reintroduced to Guam, the best available information indicates project-related noise would not further reduce the amount of recovery habitat suitable for this species' breeding, feeding and sheltering (USFWS 2010). Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Mariana crow.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of the Mariana crow with implementation of Alternative 3. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.

- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 227 acres [92 ha] of limestone forest) would be applicable for the Mariana crow and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana crow, should it be reintroduced to Guam in the future.

GUAM RAIL. The Guam rail is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the rail is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the rail, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the rail is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 3, impacts to the rail would be limited to recovery prospects. If rails are reintroduced and exposed to construction activities under Alternative 3, they may be disturbed (DON 2014).

Although the rail no longer occurs on Guam, approximately 24 acres (10 ha) of rail recovery habitat within the proposed magazine relocation area would be removed due to proposed construction activities at NAVMAG under Alternative 3. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

This loss of rail recovery habitat on Guam would not preclude the recovery or survival of the rail should it be reintroduced to Guam in the future, and it would not substantially reduce the total number of rails that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to the Guam rail with implementation of proposed construction activities associated with Alternative 3.

The following BMPs may be implemented to avoid and reduce potential long-term impacts of proposed construction activities on the recovery of the Guam rail with implementation of Alternative 3.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.

- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

In addition, potential mitigation measures proposed above for vegetation and the Mariana crow would benefit the Guam rail.

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 227 acres [92 ha] of limestone forest) would be applicable for the rail and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam rail, should it be reintroduced to Guam in the future.

GUAM MICRONESIAN KINGFISHER. The kingfisher is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the kingfisher is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the kingfisher, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the kingfisher is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 3, impacts to the kingfisher would be limited to recovery prospects. If kingfishers are reintroduced and exposed to construction activities under Alternative 3, they may be disturbed (DON 2014).

Although the kingfisher no longer occurs on Guam, approximately 223 acres (90 ha) of kingfisher recovery habitat would be removed due to proposed construction activities at the NAVMAG under Alternative 3. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Although this loss of kingfisher recovery habitat on Guam would not preclude the recovery of the kingfisher should it be reintroduced to Guam in the future, it would reduce the total number of kingfishers that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam Micronesian kingfisher.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the recovery of the Guam Micronesian kingfisher with implementation of Alternative 3. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 227 acres [92 ha] of limestone forest) would be applicable for the rail and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the kingfisher, should it be reintroduced to Guam in the future.

MARIANA COMMON MOORHEN. Seasonal and permanent wetlands/ponds that provide suitable habitat for moorhens (i.e., open water) are limited on Guam and the lack of sufficient wetland areas is a limiting factor in the recovery of the species. In 1991 and 2004, there were an estimated 22 seasonal or permanent wetlands on Guam that were utilized by moorhens (Stinson *et al.* 1991; Takano and Haig 2004a). Most wetlands used by moorhens on Guam are less than 1.5 acres (0.6 ha) in size. Identifying essential wetlands and site fidelity are especially important since wetland habitat is increasingly very limited on Guam. Because most of the large natural wetlands are overgrown with persistent vegetation and dense monocultures of *P. karka*, moorhens are increasingly left with fewer and fewer wetlands to choose from, particularly at the onset of the dry season when seasonal wetlands begin to dry up (Stinson *et al.* 1991; Takano and Haig 2004a, 2004b).

Implementation of Alternative 3 would directly impact and remove two wetlands that are known to be used by approximately 2-4 moorhens. Based on the limited occurrence of wetlands on Guam that can support moorhens, and their importance in the continued persistence of moorhens on Guam, the loss of 2 wetlands under Alternative 3, or almost 10% of the 22 known wetlands on Guam that are used by moorhens, would be a significant but mitigable impact to the Mariana common moorhen.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the Mariana common moorhen with implementation of Alternative 3. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.

- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Pre-Construction Surveys*. Surveys would be completed within suitable moorhen wetland habitat 1 week prior to onset of construction activities following the USFWS-approved JRM protocol. If a moorhen is present within a wetland within the project site, the work must be postponed until the moorhen has left the area.

Potential Mitigation Measures

- *Moorhen Habitat Wetland Restoration.* The DON may implement wetland restoration in accordance with the recommendations provided in the 2014 Wetland Restoration Feasibility Study.

MARIANA EIGHT-SPOT BUTTERFLY. Although adults, larvae or eggs of the eight-spot butterfly have not been observed within the Alternative 3 action area, host plants have been observed within the proposed MPMG Range in the northwest portion of the proposed Alternative 3 (see Figure 5.2.8-3). With implementation of appropriate BMPs to avoid and minimize potential impacts to eight-spot butterflies (e.g., pre-construction butterfly and host plant surveys within the proposed construction footprint and salvage/relocation of host plants, larvae or eggs; see Section 2.8), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed construction activities associated with Alternative 3. In addition, implementation of the potential mitigation measures described above under *Vegetation* (i.e., forest enhancement of 227 acres [92 ha] of limestone forest) would also benefit the survival the eight-spot butterfly. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species, including eight-spot butterfly host plants.

SERIANTHES TREE. Although individual *Serianthes* trees do not occur within the impacted areas of Alternative 3, approximately 40 acres (16 ha) of *Serianthes* recovery habitat would be removed due to proposed construction activities at the NAVMAG. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

This loss of *Serianthes* recovery habitat on Guam would not preclude the recovery of *Serianthes*, and it would not substantially reduce the total number of *Serianthes* that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to *Serianthes* with implementation of proposed construction activities associated with Alternative 3.

The following BMPs may be implemented to avoid and minimize, potential direct long-term impacts of proposed construction activities on the recovery of *Serianthes* with implementation of Alternative 3.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

The implementation of the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 227 acres [92 ha] of limestone forest) would benefit *Serianthes* particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

TABERNAEMONTANA ROTENSIS AND CYCAS MICRONESICA. An individual *T. rotensis* and areas of *C. micronesica* were observed within the footprint of the proposed MPMG Range (see Figure 5.2.8-3). Under Alternative 3, all *T. rotensis* and *C. micronesica* would be avoided to the maximum extent practicable during proposed construction activities. In addition, high-value (both biologically and culturally) plant species, such as *T. rotensis and C. micronesica* would be salvaged to the maximum extent practicable during construction activities and translocated to suitable habitat on the NAVMAG (see Section 2.8). Therefore, with implementation of the previously mentioned BMPs (e.g., avoidance, or salvage and translocation), there would be less than significant impacts to *T. rotensis and C. micronesica* with implementation of the proposed construction activities associated with Alternative 3.

Special-Status Species: Guam-Listed and SOGCN

PACIFIC SLENDER-TOED GECKO. The Pacific slender-toed gecko is listed by Guam as endangered. This species is threatened primarily by introduced species (e.g., feral ungulates, curious skinks, musk shrews, rats, brown treesnakes, and feral cats) and loss of limestone forest habitat. The gecko is known from primary and secondary limestone forest in the Alternative 3 impacted area of the proposed MPMG Range (see Figure 5.2.8-3). The full extent of the distribution and abundance of this species throughout Guam has not been assessed. The loss of approximately 169 acres (68 ha) of occupied gecko habitat with implementation of construction activities under Alternative 3 would be a significant but mitigable impact to the Pacific slender-toed gecko.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct long-term impacts of proposed construction activities on the slender-toed gecko with implementation of Alternative 3. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

The potential forest enhancement mitigation measures described above in the *Vegetation* section would also result in a conservation benefit to the Pacific slender-toed gecko. The proposed brown treesnake research and suppression may also benefit this species. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW potential mitigation discussion for more information.

MERRILLIODENDRON MEGACARPUM. An area of *M. megacarpum* was observed within the footprint of the proposed MPMG Range (see Figure 5.2.8-3). Under Alternative 3, all *M. megacarpum* would be avoided to the maximum extent practicable during proposed construction activities. In addition, high-value (both biologically and culturally) plant species, such as *M. megacarpum* would be salvaged to the maximum

extent practicable during construction activities and translocated to suitable habitat on the NAVMAG (see Section 2.8). Therefore, with implementation of the previously mentioned BMPs (e.g., avoidance, or salvage and translocation), there would be less than significant impacts to *M. megacarpum* with implementation of the proposed construction activities associated with Alternative 3.

Operation

Vegetation. With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, applicable elements of the SIP, and 1-year post construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of Alternative 3 is considered unlikely.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by increasing erosion, allowing for the establishment of non-native species, and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. Native plants and their habitats on Guam are adapted to a humid, tropical climate and are not adapted to a fire driven ecosystem (USFWS 2008a). Fire is a serious problem on Guam. Fire history records available from 1979 - 2002 indicate that over this 23-year period more than 16,000 fires have occurred in Guam (averaging more than 700 per year) that have burned in excess of 100,000 acres (40,469 ha), primarily in southern Guam. Of these 16,000 fires, 477 of them occurred on Naval Base Guam, primarily at Apra Harbor and NAVMAG, burning more than 9,800 acres (3,966 ha) (Nelson 2008).

As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's Wildland Fire Management Plan (Nelson 2008) (see Section 2.8). It would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions), and location and management of firebreaks, fire-fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). With implementation of the Range Fire Management Plan, which establishes management and fire suppression and emergency response procedures, potential impacts from range-related wildfires would be less than significant. The USFWS concluded in their BO for the 2010 Final EIS that they anticipated that no additional vegetation would be lost due to wildfires igniting as a result of proposed live-fire training operations (USFWS 2010a). Therefore, there would be less than significant impacts to vegetation from operation of LFTRC Alternative 3.

Terrestrial Conservation Areas. Impacts to terrestrial conservation areas from the operation of the HG Range at Andersen South were discussed in Section 5.1.8.2. As Andersen South does not contain any terrestrial conservation areas, there would be no impacts.

Modeled noise levels greater than 55 dB ADNL from proposed live-fire range operations would overlie approximately 2,993 acres (1,211 ha) of Overlay Refuge lands on the NAVMAG (Table 5.3.8-4 and Figure 5.3.8-2). Overlay Refuge lands were established for the purpose of conserving and protecting ESA-listed species and other native flora and fauna, maintaining native ecosystems, and the conserving native biological diversity, recognizing that the primary purpose of lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force.

Table 5.3.8-4. Noise Levels within Overlay Refuge Lands with Implementation of LFTRC Alternative 3 (acres [ha])

55-64 dB ADNL	*65-74 dB ADNL*	*75-85+ dB ADNL*	*Total*
1,357.0 (549.2)	1,124.7 (455.2)	511.1 (206.8)	**2,992.8 (1,211.1)**

Although there would be an increase in noise associated with LFTRC activities, the proposed noise-generating activities would not result in a loss of the conservation function of Overlay Refuge lands and support the national defense missions of the Navy and Air Force at the NAVMAG. Therefore, there would be less than significant impacts to terrestrial conservation areas with implementation of Alternative 3.

Wildlife - Native Species. Operational impacts to native wildlife would include an increase in noise and lighting. These potential impacts were evaluated in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.2: Central, page 10-129) for a similar proposed action, and were found to be not significant. With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, applicable elements of the SIP, and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the proposed LFTRC under Alternative 3 is considered unlikely.

The DON recognizes the USFWS' ongoing concern regarding potential spread of the brown treesnake. The DON will consult with USFWS under ESA section 7 to determine if additional brown treesnake interdiction measures are warranted and applicable. In addition, lighting associated with the range and support areas would be hooded or shielded to the maximum extent practicable to prevent unnecessary light beyond operational areas. Therefore, there would be less than significant impacts to native wildlife with operation of the proposed LFTRC under Alternative 3.

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. The assessment of noise levels associated with the proposed HG Range at Andersen South was previously discussed in Section 5.1.8.2. There would be no impacts to Mariana fruit bats from noise associated with operation of the HG Range.

For those species of fruit bats that have been tested for hearing sensitivity, their audiograms are very similar to those of humans, with similar upper and lower frequency limits and hearing threshold levels (Calford *et al.* 1995; Koay *et al.* 1998; Heffner *et al.* 2006). Therefore, it is likely that noise from live-fire operations at the proposed ranges would be heard by fruit bats as it would be heard by humans.

The USFWS established 60 dB and 93 dB as two thresholds of biological significance based on their review of impacts of noise to wildlife. Noise levels above 60 dB have been found to affect acoustic communication, breeding biology, survival of young, and non-auditory bird and mammal physiology. Noise levels above 93 dB may temporarily or permanently affect hearing (USFWS 2010a). No species would be exposed to noise levels of 93 dB or greater under the proposed action. While noise levels may approach 93 dB in the immediate vicinity of the firing of an individual weapon, fruit bats or other wildlife species would not be in proximity to the live-fire event given the location and nature of weapons firing within a developed range area.

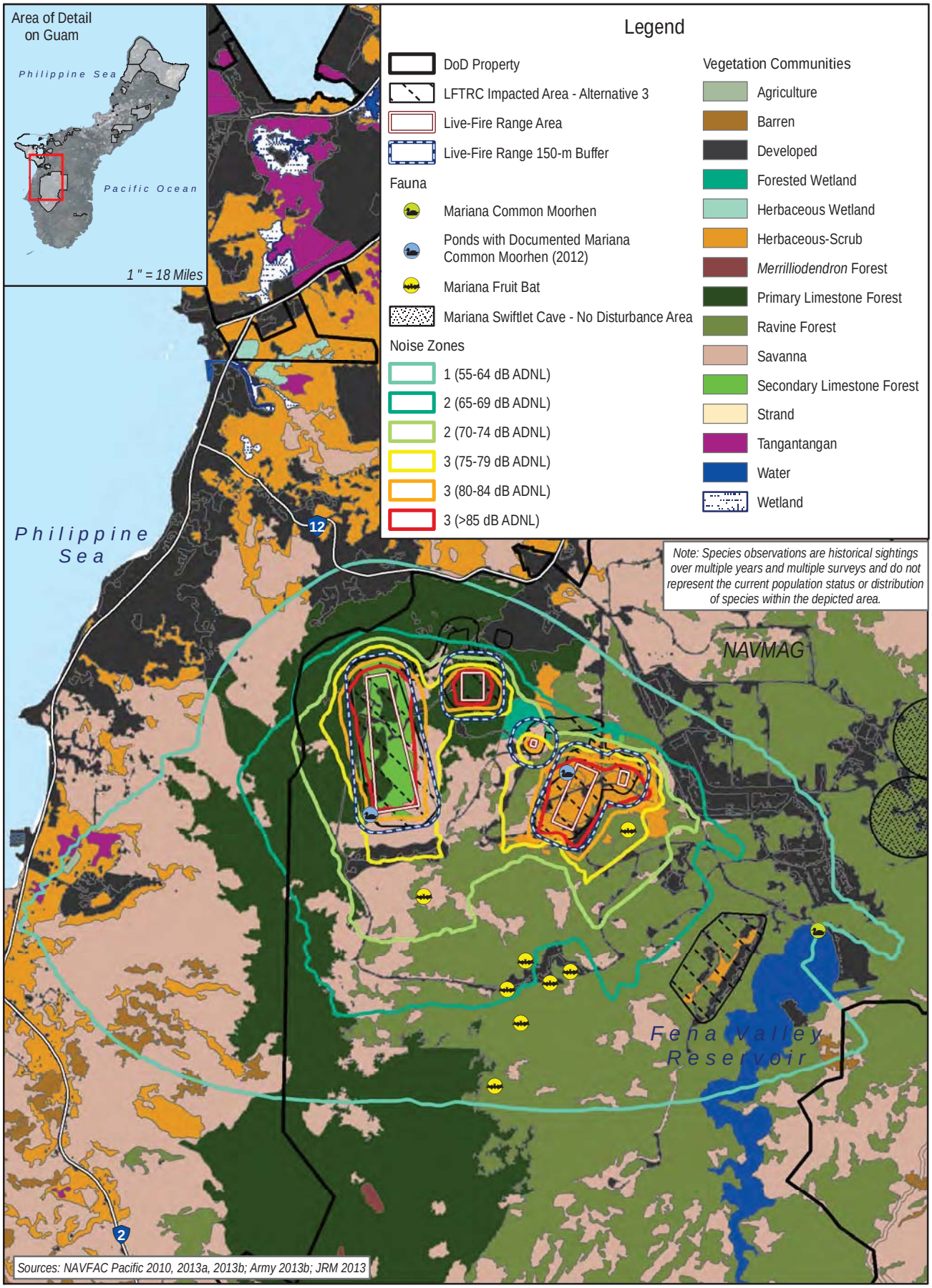


Figure 5.3.8-2
Vegetation Communities and Special-Status Wildlife Species Observations within Small Arms ADNL Noise Zones - NAVMAG (North/South) LFTRC Alternative

Responses to noise can vary among individuals as a result of habituation where after a period of exposure to a stimulus, an animal stops responding to the stimulus. In general, a species can often habituate to human-generated noise when the noise is not followed by an adverse impact. Even when a species appears to be habituated to a noise, the noise may produce a metabolic or stress response (increased heart rate results in increased energy expenditure) though the response may or may not lead to changes in overall energy balance. Anthropogenic noise disturbance is known to alter animal behavioral patterns and lead to population declines (Barber *et al.* 2011; Francis and Barber 2013; McGregor *et al.* 2013).

In addition to noise level, the frequency and regularity of the noise also affect species sensitivity. That is, different types of noise sources will produce different effects on different species. Noise from aircraft overflights may not produce the same response from a wildlife species as noise from a land-based noise source such as a vehicle, chainsaw, or gun shot. Wildlife species often do not react only to a noise source but more importantly to the visual component associated with that noise source. Nesting birds will react to a noise source by tilting their head, becoming alert, etc. but often do not leave the nest or perch until there is a visual connection with the noise source. For example, birds may not react to just the sound of a chainsaw, but when that sound is coupled with a human walking near the bird, the bird will flush. This is also shown in reactions by various species to aircraft overflights (airplanes and helicopters). An overflight with just a sound component does not elicit a strong response, but if an animal hears and then sees the aircraft, the bird will more likely flush and move away (Manci *et al.* 1988; USFWS 1992; Krausman *et al.* 1993; Bowles 1995). In other words, human intrusions near roost sites, nests, foraging areas, etc. (e.g., timber harvesting, hiking, hunting) are readily detectable and substantial (USFS 1992).

Species that are commonly hunted often demonstrate behavioral (e.g., flushing, startle response) or physiological responses (e.g., increased heart rates, increased respiration rates) to gunshot sounds (Larkin *et al.* 1996). Knight *et al.* (1987) found that American crows nesting in urban areas were less wary of people than American crows nesting in rural habitat and attributed the difference to the hunting of rural crows. Barron *et al.* (2012) found that American crows avoided areas with live-fire exercises in a similar fashion and suggested that species hunted by humans will be more adversely affected by human activity, including military training (e.g., live-fire training) than species that are not hunted.

As stated by Morton and Wiles (2002), "Poaching is a particularly insidious activity because not only does it impact fruit bats through mortality, it reinforces behavioral avoidance of humans. Consequently, roosting or foraging fruit bats that might not otherwise be disturbed by some human activities … may become unduly sensitized to them because of illegal hunting." Based on observations on Guam and Rota, fruit bats have abandoned areas where hunting has occurred and did not return even though no further hunting or gunshots occurred within the area for months after (Janeke 2006; AAFB 2008b; USFWS 2009a; Mildenstein and Mills 2013). In addition, anecdotal evidence from numerous individuals who have conducted fruit bat research on Guam and the CNMI for many years indicate that fruit bats do avoid areas that have been previously subjected to hunting and also areas that experience live-fire activities (G. Wiles, Washington Department of Fish and Wildlife, personal communication, 2014; T. Mildenstein, University of Montana, personal communication, 2014; D. Janeke, HDR, Inc., personal communication, 2014; N. Johnson, Marianas Conservation Unlimited, personal communication, 2014). For example, during fruit bat monitoring at AAFB near the CATM range as part of a larger study monitoring the effects of aircraft overflights on fruit bats and crows (JRM *et al.* 2012b), N. Johnson observed flying fruit bats avoid the CATM range by 300-400 m when live-fire operations were being conducted (N. Johnson, Marianas Conservation Unlimited, personal communication, 2014).

However, a species can also habituate to human-generated noise when the noise is not followed by an adverse impact. While fruit bats may avoid an area subjected to hunting and the associated gun shots, fruit bats, like most wildlife species, will also learn that if a disturbance or sound does not produce an adverse effect (e.g., mortality), then they can habituate to that disturbance or sound and will not show an adverse reaction (e.g., flying away, avoiding the area) (Boyle and Samson 1985; Francis and Barber 2013).

Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) may influence reproductive success and confound the ability to identify the ultimate factor in limiting productivity of a certain species, area, or region (Smith *et al.* 1988).

Based on identified recovery habitat for the Mariana fruit bat (USFWS 2010b), noise levels of 60 dB ADNL and greater would overlie 1,534 acres (621 ha) of recovery habitat in the vicinity of Alternative 3 (Table 5.3.8-5).

Table 5.3.8-5. Noise Levels overlying Mariana Fruit Bat Recovery Habitat (acres [ha]) with Implementation of LFTRC Alternative 3

60-64 dB ADNL	*65-74 dB ADNL*	*75-85+ dB ADNL*	*Total*
429.7 (173.9)	807.0 (326.6)	297.8 (120.5)	**1,534.5** **(621.0)**

Given the ongoing poaching of fruit bats on Guam, it is likely that those fruit bats that currently occur on Guam will avoid areas of live-fire training as they may have experienced a poaching event. While there is the potential for eventual habituation by fruit bats to LFTRC live-fire activities, fruit bats are expected to initially avoid areas of live-fire training activities. Therefore, fruit bats may temporarily avoid approximately 1,534 acres (621 ha) of recovery habitat due to proposed live-fire range operations. However, proposed live-fire operations at the LFTRC are not continuous and would occur between 7:00 a.m. and 7:00 p.m. for 39 weeks per year, and night operations (estimated to occur 2 nights per week over 39 weeks per year) would occur between 7:00 p.m. and 10:00 p.m. or 6:00 a.m. and 7:00 a.m. In addition, live-fire operations would not physically impact recovery habitat. This temporary avoidance of recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, and it would not substantially reduce the total number of fruit bats that the island can support.

With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, applicable elements of the SIP, and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of Alternative 3 is considered unlikely. Therefore, there would be less than significant impacts to the Mariana fruit bat with implementation of proposed operational activities associated with Alternative 3.

MARIANA CROW, GUAM RAIL, AND GUAM MICRONESIAN KINGFISHER. These species are extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of these species is reasonably certain to occur and the species are likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of these species, nor successful suppression

of the brown treesnake to a level which would support re-introduction. Until the crow, rail, and kingfisher are successfully re-introduced and then have the potential to be exposed to operational activities under Alternative 3, there would be no impact to these species. If the species are reintroduced and exposed to LFTRC operational activities under Alternative 3, they may be disturbed.

MARIANA SWIFTLET. Based on surveys conducted for this SEIS, swiftlets were observed within the vicinity of the proposed ranges or within the modeled noise contours associated with the proposed ranges under Alternative 3 (see Figure 5.3.8-2). Swiftlets would continue to forage within the extensive foraging habitat to the north, west, and east of the proposed range areas, and areas in the vicinity of the nest/roost caves on NAVMAG and the drainages of the Mahlac, Maagas, and Talofofo rivers (see Figures 5.2.8-1 and 5.2.8-3). The proposed range operations would not impact regional insect populations that are the prey base for the swiftlet. In addition, swiftlets are generally more actively foraging in the early morning and late evenings before and after proposed range operations. As swiftlets do not have a history of being hunted, they would not have the same aversion to gunfire that Mariana fruit bats have and, therefore, may not avoid areas of live-fire range operations. Proposed range operations and associated noise would not impact the swiftlet nesting/roosting caves approximately 1 mile (1.6 km) to the east of the proposed ranges, and the nest caves would not be within the modeled noise contours associated with the proposed ranges. Therefore, given the extensive remaining foraging habitat within the surrounding areas that would still be available for foraging, and that swiftlets would still forage in the mornings and evenings before and after range operations, there would be less than significant impacts to the Mariana swiftlet due to proposed range operations under Alternative 3.

MARIANA COMMON MOORHEN. The modeled 55 dB ADNL noise contour overlies the northern portion of Fena Valley Reservoir, an important nesting area for moorhens on Guam. Given the low modeled noise level that may occur within the northern portion of the reservoir (i.e., 55 dB ADNL is approximately equal to ambient noise levels; see Section 3.4, Noise), there would be less than significant impacts to Mariana common moorhens with implementation of the proposed range operations under Alternative 3.

MARIANA EIGHT-SPOT BUTTERFLY. Some species of tropical butterflies have well-developed ears on their wings and can detect sounds at the same frequencies that humans can hear. It is hypothesized that the butterflies are listening to the flight sounds or foraging calls of predatory birds (Lane *et al.* 2008; Yack 2012). Given the low numbers of forest birds currently on Guam due to the brown treesnake, masking of the flight sounds or foraging calls of predatory birds due to noise from proposed construction activities would not make eight-spot butterflies more susceptible to predation.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by increasing erosion, allowing for the establishment of non-native species, and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. Native plants and their habitats on Guam are adapted to a humid, tropical climate and are not adapted to a fire driven ecosystem (USFWS 2008a).

As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's Wildland Fire Management Plan (Nelson 2008) (see Section 2.8). It would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions), and location and management of firebreaks, fire-fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). With implementation of the Range Fire Management Plan, which establishes management and fire suppression and emergency

response procedures, potential impacts from range-related wildfires would be less than significant. The USFWS concluded in their BO for the 2010 Final EIS that they anticipated that no additional vegetation would be lost due to wildfires igniting as a result of proposed training operations (USFWS 2010a). Therefore, as operation of the range would not remove additional vegetation (e.g., host plants), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed range operations under Alternative 3.

SERIANTHES TREE. *Serianthes* does not occur within the Alternative 3 action area. Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see *Vegetation* above, and Section 2.8), potential impacts from range-related wildfires on *Serianthes* would be less than significant. Therefore, there would be less than significant impacts to *Serianthes* or recovery habitat due to proposed range operations under Alternative 3.

TABERNAEMONTANA ROTENSIS AND *CYCAS MICRONESICA.* Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see *Vegetation* above, and Section 2.8), potential impacts from range-related wildfires on *T. rotensis* and *C. micronesica* would be less than significant. There would be no other impacts to *T. rotensis* and *C. micronesica* with implementation of the proposed range operations associated with Alternative 3.

Special-Status Species: Guam-Listed and SOGCN

PACIFIC SLENDER-TOED GECKO. Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see *Vegetation* above, and Section 2.8), potential impacts from range-related wildfires on the Pacific slender-toed gecko would be less than significant. There would be no other impacts to the Pacific slender-toed gecko with implementation of the proposed range operations associated with Alternative 3.

MERRILLIODENDRON MEGACARPUM. Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see *Vegetation* above, and Section 2.8), potential impacts from range-related wildfires on *M. megacarpum* would be less than significant. There would be no other impacts to *M. megacarpum* with implementation of the proposed range operations associated with Alternative 3.

5.3.9 Marine Biological Resources

5.3.9.1 Affected Environment

The Alternative 3 proposed project area is entirely inland, with no marine in-water or coastal components. Therefore, there is no marine biological resources affected environment for Alternative 3.

5.3.9.2 Environmental Consequences

There are no in-water construction, dredging, or training activities and/or land-based construction activities proposed under Alternative 3 that would directly or indirectly affect the marine environment. Therefore, no direct or indirect impacts are expected.

Scoping comments for this SEIS noted concern regarding the possibility that contamination could migrate from the ranges through stormwater runoff. However, as discussed in Section 5.3.2, Water Resources, there would be no impacts to nearshore waters through implementation of surface water protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs

during construction and implementation of LID features in accordance with the DoD UFC LID [UFC 3-210-10] and Section 438 of the EISA, range maintenance BMPs, and pollution prevention plans during operations).

5.3.10 Cultural Resources

5.3.10.1 Affected Environment

The following discussion summarizes previous cultural resources studies, known historic properties, and other cultural resources within PDIA and PIIA associated with Alternative 3. The Alternative 3 area, also known as NAVMAG (North/South), is situated in the south-central portion of Guam almost entirely within NAVMAG. As early as December 1944, miles of roads and magazines were constructed at NAVMAG and the area was commissioned on February 22, 1945 (Mason Architects and Weitze Research 2009). During a limited expansion in the Korean conflict of the early 1950s, most of the present main administration buildings and many of the magazines were designed and built as part of the permanent base development program for Guam.

The affected environment for cultural resources associated with Alternative 3 is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 12: Cultural Resources, Section 12.1.5.1: Naval Munitions Site, pages 12-33 to 12-38). This description of the affected environment is updated here with new information from recent archaeological and architectural investigations conducted for this SEIS and other projects. To determine whether site information is from previous investigations (such as the 2010 Final EIS or other cultural resource studies) or prepared during in-fill studies conducted for this SEIS, refer to dates in the reference column in each table for the archaeological sites. Certain information about built properties (such as date and function) was derived from iNFADS.

Portions of the Alternative 3 PDIA and PIIA were surveyed for the presence of cultural resources for the original proposed action (2010 Final EIS). Those and other previous investigations in the area included intensive archaeological surveys (Tuggle 1993; Hunter-Anderson 1994; Craib and Nees 1998; Henry *et al.* 1999; Allen *et al.* 2002; Hunter-Anderson and Moore 2002; Dixon *et al.* 2004; Welch 2010), architectural inventories (Mason Architects and Weitze Research 2010; Welch 2010), and potential TCP studies (Griffin *et al.* 2010). Additional investigations conducted for this SEIS included intensive cultural resource inventories conducted for the PDIA and reconnaissance inventories in the PIIA for this SEIS (Dixon *et al.* 2015a, 2015b). Note that due to changes in Alternative 3 as a result of the SEIS planning process, 48 acres (19.4 ha) within the PDIA and 184.19 acres (74.5 ha) in the potential indirect impact area were added after the surveys were conducted. These 232.2 acres (94 ha) were examined through historic materials, aerials, and a comparison with adjacent areas to assess impacts to cultural resources. Collectively, these investigations provide the comprehensive inventory of cultural resources for Alternative 3.

As described in Section 5.1.10.1, the HG Range would be located at Andersen South under all LFTRC alternatives. This area was previously surveyed at an intensive level (Welch 2010; Dixon *et al.* 2011a).

During October through December 2014, the DON consulted with the parties to the 2011 PA and the public on the Draft TRRA. Consistent with Stipulation V.C of the 2011 PA, the TRRA provided planning level information on potential direct and indirect effects to historic properties within areas that may be selected in the Navy's ROD for the live-fire training range complex. The Draft TRRA included information on the locations, orientations, and designs of each proposed LFTRC location. In addition to receipt of written comments, DON cultural resources professionals conducted three consultation sessions with the parties to the PA to discuss the analysis. The DON will take all comments into account in preparing the Final TRRA, which is planned for publication shortly after this Final SEIS. Comments and considerations developed during the Draft TRRA consultation process have been incorporated in this Final SEIS and informed the Draft RMP, as required by Stipulation V.C.4 of the 2011 PA.

Cultural Resources in the Alternative 3 PDIA

Alternative 3 would involve the construction of individual ranges, support buildings, a munitions magazine relocation area, and access roads. This construction area comprises the PDIA. Table 5.3.10-1 lists 15 known archaeological sites located within the Alternative 3 PDIA within the NAVMAG. Eleven sites, including sites with *latte* sets, rockshelters, WWII military sites, and artifact scatters, are eligible for listing in the NRHP. Two sites, consisting of an historic artifact scatter, and a *latt*e site have not been evaluated for listing in the NRHP. Two historic WWII sites are not considered eligible for inclusion in the NRHP. Should this alternative be selected, final assessments would be determined consistent with the procedures outlined in the 2011 PA.

No historic properties have been identified in the PDIA of the proposed HG Range at Andersen South.

Table 5.3.10-1. Archaeological Sites and Potential TCPs within the Alternative 3 PDIA

GHPI Number[1]	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-02-0145A	29*	West Bonya Complex	Pre-Contact/Latte	Craib and Yoklavich 1997	Yes	D
66-02-0145B	30*	East Bonya Complex	Pre-Contact/Latte	Craib and Yoklavich 1997	Yes	D
66-02-1659	496*	Trenches & foxholes[2]	WWII Japanese Military Occupation	Allen *et al.* 2002	Yes	D
66-02-1660	497*	*Latte* set & rockshelter complex[2]	Pre-Contact/ Pre-Latte/Latte	Allen *et al.* 2002	Yes	D
	31/555*	Foxhole, cave[2]	WWII Japanese Military Occupation	Henry *et al.* 1999	Yes	D
	32/556*	Rockshelter[2]	Pre-Contact/Latte	Henry *et al.* 1999	Yes	D
	66/587*	*Latte* cluster	Pre-Contact/Latte	Henry *et al.* 1999	Yes	D
	69/589*	*Latte* set[2]	Pre-Contact/Latte	Henry *et al.* 1999	Yes	D
	78/598*	Artifact scatter[2]	WWII Japanese Military Occupation	Henry *et al.* 1999	Yes	D
	79/599*	Enclosure[2]	WWII Japanese Military Occupation	Henry *et al.* 1999	Yes	D
	80/600*	Overhang[2]	Pre-Contact/Latte	Henry *et al.* 1999	Yes	D
	114/633*	Artifact scatter[2]	Post-WWII/Second American Territorial	Henry *et al.* 1999	Not Evaluated	NA
	T-NMS-001	*Latte* set[2]	Pre-Contact/Latte	Dixon *et al.* 2015b	Not Evaluated	NA
	OA-8/808*	Concrete slab[2]	Post-WWII/Second American Territorial WWII/Second American Administration Territorial	Hunter-Anderson and Moore 2002	No	NA
66-09-2626	T-NMS-002	Artifact scatter[2]	Organic Act/Home Rule/Economic Development WWII/Home Rule	Dixon *et al.* 2015a	No	NA
		Bona Springs/Potential landscape TCP	Pre-Contact/Latte, Post WWII/Second American Territorial, Organic Act/ Home Rule/Economic Development	Griffin *et al.* 2010	Yes^	A

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion D = eligible for potential to yield information important in prehistory or history.

Notes: [1] Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys

[2] Sites are in both the PDIA and the PIIA.

*Map numbers from Welch *et al.* 2009.

** Revised to match Guam GHPI forms dated May 28, 2014.

^ Eligibility of this site has not been fully determined. However, for the purpose of this analysis, it is assumed eligible.

Table 5.3.10-2 lists the 24 known structures and buildings within the Alternative 3 PDIA. All of these structures and buildings are covered under the 2006 *Program Comment for World War II and Cold War Era Ammunitions Storage Facilities* (ACHP 2006).

Table 5.3.10-2. Summary of Architectural Properties Located within the Alternative 3 PDIA

Building/Structure Type	*Location*	*Number of Buildings/Structures of this Type in Potential Impact Area*	*Date of Construction*	*NRHP Eligible?*
ARMCO Magazines (Facility Nos. 1, 10, 14, 15, 17, 23, 112, 113, 114, 120)/Map No. 21	NAVMAG	10	1944 to 1945	Covered under Program Comment
ARMCO Magazines (Facility Nos. Not Available)	NAVMAG	2	1944 to 1945	Covered under Program Comment
Earthen Revetments	NAVMAG	8	1944-45	Covered under Program Comment
Quonset Hut Style Magazine	NAVMAG	1	Post-1946	Covered under Program Comment
Inert Storehouse (Facility No. 310NM)/Map No. 37	NAVMAG	1	1949	Covered under Program Comment
Magazine Fuse Detonator (Facility No. 454NM)	NAVMAG	1	1952	Covered under Program Comment
Ammunition Rework/Overhaul (Facility No. 465NM)	NAVMAG	1	1955	Covered under Program Comment

Note: Information on type, number, and date of construction from iNFADS.

One potential TCP, Bona Springs, is located within the PDIA for Alternative 3.

Cultural Resources in the Alternative 3 PIIA

The PIIA comprises within the SDZs for the LFTRC and HG ranges and associated areas potentially affected by increases in noise. It includes no locations of potential direct impact due to construction. Table 5.3.10-3 summarizes the 218 known archaeological sites located within the Alternative 3 PIIA. There are 210 NRHP-eligible sites, including artifact scatters, *latte* sites, rockshelters, and historic military features. Three sites have not been evaluated for listing in the NRHP. The remaining five sites are not eligible for listing in the NRHP. Should this alternative be selected, final assessments would be determined consistent with the procedures outlined in the 2011 PA.

Table 5.3.10-3. Summary of Archaeological Sites and Potential TCPs Known to be Located within the Alternative 3 PIIA

Site Type	*Period***	*Number of Sites of this Type in the Impact Area*	*NRHP Eligible?*	*NRHP Criteria*
Artifact Scatter	Pre-Contact/Latte	26	Yes	D
Artifact Scatter	Post-WWII/Second American Territorial	11	Yes	D
Artifact Scatter	Post-WWII Second American Territorial	1	Not Evaluated	NA
Artifact Scatter	WWII Japanese Military Occupation	2	Yes	D
Artifact Scatter	WWII Japanese Military Occupation	1	Not Evaluated	NA
Artifact Scatter	Post-WWII/Second American Territorial/ Organic Act/Home Rule/Economic Development	3	No	NA
Artifact Scatters	Mixed Component	2	Yes	D
Latte Sites	Pre-Contact/Latte	1	Not Evaluated	NA
Latte Sites	Pre-Contact/Latte	79	Yes	D
Latte Sites	Pre-Contact/Latte	4	Yes	C, D
Latte Sites	Mixed Component	12	Yes	D
Rockshelters/Caves/ Overhangs/Crevices	Pre-Contact	47	Yes	D
Rockshelters/Caves	Mixed Component	14	Yes	D
Rockshelters/Caves	Historic	4	Yes	D
Mortar	Pre-Contact/Latte	1	Yes	D
Tunnel Complex	Post-WWII/Second American Territorial/ WWII Japanese Military Occupation	1	Yes	D
Trenches/Foxholes/Caves/Enclosures	WWII Japanese Military Occupation	3	Yes	D
Alifan Ridge Cave Complex (probable defense position)	WWII Japanese Military Occupation	1	Yes	D
West Tower Outlook Post Remnants	Post-WWII/Second American Territorial	1	Yes	D
Historic Feature	Post-WWII/Second American Territorial	2	No	NA
Historic Feature	Post-WWII/Second American Territorial	1	Yes	D
Cave and Pictograph Panel	Pre-Contact/Latte	1	Yes	C, D
Potential TCP	Pre-Contact/Latte, Post WWII/Second American Territorial, Organic Act/ Home Rule/Economic Development	6	Yes^	A

Legend: NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion C = eligible because they embody the distinctive characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic value or represent a significant and distinguishable entity whose components may lack individual distinction, criterion D = eligible for potential to yield information important in prehistory or history.

Note: ** Revised to match Guam GHPI forms dated May 28, 2014.

^ Eligibility of this site has not been fully determined. However, for the purpose of this analysis, it is assumed eligible.

There are 72 architectural properties, constructed between 1944 and 1997, located within the PIIA for Alternative 3 (Table 5.3.10-4). These buildings and structures are primarily associated with WWII and Cold War-era ammunition storage and support facilities. Fifty-seven of the structures are ammunition storage facilities covered under the *Program Comment for World War II and Cold War Era Ammunition Storage Facilities* (ACHP 2006; see Chapter 3.10.3 for more information on the Program Comment). Eleven buildings and structures greater than 50 years in age have not been evaluated. Four structures are less than 50 years old and do not meet the exceptional significance threshold required under NRHP Criteria Consideration G. Should this alternative be selected, final assessments would be determined consistent with the procedures in the 2011 PA.

Table 5.3.10-4. Summary of Architectural Properties Located within the Alternative 3 PIIA

Building/Structure Type	*Location*	*Number of Buildings/Structures of this Type in Potential Impact Area*	*Date of Construction*	*NRHP Eligible?*
ARMCO Magazines (Facility Nos. 1, 10, 14, 15, 17, 23, 112, 113, 114, 120)/Map No. 21	NAVMAG	10	1944 to 1945	Covered under Program Comment
ARMCO Magazines (Facility Nos. Not Available)	NAVMAG	8	1944 to 1945	Covered under Program Comment
ARMCO Magazine (Facility No. 188)	NAVMAG	1	1944 to 1945	Covered under Program Comment
Explosive Truck Holding Yard (Facility Nos. 629-639)/Map No. 34	NAVMAG	11	1944 to 1945	Not Evaluated
Inert Storehouses (Facility No. 309NM & 310NM)/Map Mo. 37	NAVMAG	2	1949	Covered under Program Comment
Open Storage Areas/ Revetments Complex (Facility Nos. 612, 614, 616, 617, 618, 619, 622, 621, 623, 624, 628)/Map No. 43	NAVMAG	11	1944 to 1945	Covered under Program Comment
Earthen Revetments	NAVMAG	20	1944 to 1945	Covered under Program Comment
High Explosive Magazines (Facility Nos. 434-437)/Map No. 1053	NAVMAG	4	1952	Covered under Program Comment
Magazine Fuse Detonator (Facility No. 454NM)	NAVMAG	1	1952	Covered under Program Comment
Ammunition Rework/Overhaul (Facility No. 779NM)	NAVMAG	1	1965	No
EOD Crew Blast Shelter (Facility No. 862NM)	NAVMAG	1	1976	No
Utility Building (Facility No. 840NM)	NAVMAG	1	1969	No
Close Quarter Battle Breach Training (Facility No. 640NM)	NAVMAG	1	1997	No

Six potential TCPs have been identified in the PIIA for this alternative. They include Bona Springs (which is also within the PDIA), Almagosa Springs, Dobo Springs, Almagosa Mountain, Alifan peak, and a high density area of *latte* sites (Griffin *et al.* 2010).

5.3.10.2 Environmental Consequences

Construction

Construction activities associated with Alternative 3 have the potential to adversely affect historic properties and impact culturally important natural resources. Final determinations of effect would follow the procedures outlined in the 2011 PA. Following is a discussion of potential direct and indirect adverse effects to historic properties and impacts to culturally important natural resources.

Construction of the ranges, support facilities, relocated magazine, and utilities would occur in the NAVMAG (see Figure 2.5-4). Given the substantial development anticipated in the PDIA, it is assumed for purposes of this analysis that 100% of the PDIA would be disturbed. Nevertheless, design alternatives to avoid and minimize adverse effects would be considered, consistent with procedures in the 2011 PA. No construction would occur in the PIIA. Excavation and soil removal associated with the construction of Alternative 3 could adversely affect 11 known historic properties, including Pre-Contact artifact scatters, sites containing *latte* components, rockshelters, and WWII military sites (see Table 5.3.10-1). Construction could also affect two unevaluated sites and one potential TCP (Bona Springs). Eight of the historic properties and the two unevaluated sites are located in both the PDIA and the PIIA. Direct impacts to these sites would only occur to the portion within the PDIA. Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the 48 acres (19.4 ha) of unsurveyed areas within the PDIA. If this alternative were selected, final assessments would be determined consistent with the procedures in the 2011 PA.

Construction associated with Alternative 3 may also require the demolition of 24 architectural properties (see Table 5.3.10-2). All of the buildings and structures are covered under the *Program Comment for World War II and Cold War Era (1939-1974) Ammunition Storage Facilities* (ACHP 2006), which resolves NHPA Section 106 requirements for demolition of these buildings.

Construction activities associated with Alternative 3 have the potential to directly impact culturally important natural resources. The project would require the removal of limestone forest and savanna where culturally important natural resources may be located. The 2011 PA contains measures for coordinating with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners and traditional artisans regarding identification and disposition of these important resources prior to construction (see 2010 Final EIS, Volume 2: 2-10; Volume 9, Appendix G, Chapter 4).

No historic properties or culturally important natural resources are anticipated in conjunction with utility upgrades that would be associated with Alternative 3. The modification or replacement of existing overhead electrical utilities under Alternative 3 would not affect any known cultural resources. There are no known NRHP-eligible properties located in areas planned for water or wastewater upgrades to support Alternative 3.

There are no historic properties located in the PDIA or PIIA for the proposed HG Range at Andersen South. Therefore, no adverse effects to historic properties are anticipated due to construction of the HG Range.

Operation

Operations associated with Alternative 3 could cause indirect adverse effects to historic properties as discussed below. Final determinations of effect would follow the procedures in the 2011 PA. Following is a discussion of potential adverse effects of operations associated with Alternative 3.

The potential for direct effects within the SDZ would be limited to the risk of strikes from stray rounds during Alternative 3 operations. The risk of such effects occurring is extremely low. The range would be designed to contain live fire inside the range itself to minimize the probability of rounds landing in the SDZ. Additionally, if a stray round were to escape the range, the chance of it hitting a historic property is remote, given the size of the SDZ and dispersal of historic properties. For these reasons, the potential for direct adverse effects as a result of range operations is *de minimis*.

Indirect adverse effects to NRHP-eligible archaeological sites from the operation of Alternative 3 could result from changes affecting site integrity. For many types of archaeological sites (e.g., ceramic scatters, rock alignments), auditory impacts associated with live-fire operations would not affect characteristics that qualify them for the NRHP. An increase in noise associated with live-fire operations may adversely affect historic properties for which solitude, quiet, or contemplation contribute to or define their significance, such as TCPs.

Under Alternative 3, small arms live-fire noise would be audible near 60 NRHP-eligible sites and two potential TCPs (Bona Springs and Alifan peak) that are located within the expanded noise contours (Table 5.3.10-5). Average noise levels during range operations are projected to increase from current levels of approximately 45 dB ADNL to between 65 dB to 85 dB ADNL (see Section 5.3.4, Noise). Thirty-five of the sites are Pre-Contact or historic artifact scatters, rockshelters/caves, historic military features, or other historic remains, while 25 sites contain *latte* components. Auditory impacts associated with range operations would not adversely affect the integrity of the NRHP-eligible artifact scatters, historic military features, or other historic remains. Changes to the setting of the 25 NRHP-eligible sites with *latte* components could be adverse. There may also be an effect to two potential TCPs. Final determinations of effect would follow the procedures in the 2011 PA.

Table 5.3.10-5. Summary of Archaeological Sitesand Potential TCPs Potentially Affected by Noise

Site Type	*Period*	*Number of Sites of this Type in Impact Area*	*NRHP Eligible?*	*NRHP Criteria*
Latte Sites	Pre-Contact/Latte	25	Yes	D
Rockshelters/Caves	Pre-Contact/Latte	12	Yes	D
Rockshelters/Caves	Post-Contact	4	Yes	D
Historic Artifact Scatters	Post-Contact	3	Yes	D
Pre-Contact Artifact Scatters	Pre-Contact/Latte	8	Yes	D
WWII Defenses	WWII Japanese Military Occupation	2	Yes	D
Military Sites	WWII Japanese Military Occupation/Post-WWII/Second American Territorial	2	Yes	D
Historic Various	Historic	4	Yes	D
Potenital TCP	Pre-Contact/Latte, Post WWII/Second American Territorial, Organic Act/ Home Rule/Economic Development	2	Yes^	A

Legend: NRHP = National Register of Historic Places; NRHP criterion D = eligible for potential to yield information important in prehistory or history.

Note: ** Revised to match Guam GHPI forms dated May 28, 2014.

^ Eligibility of this site has not been fully determined. However, for the purpose of this analysis, it is assumed eligible.

Similar to certain types of archaeological sites, noise associated with range operations is not likely to adversely affect the integrity of ammunition storage support facilities. Therefore, no indirect effects are anticipated to buildings and structures from changes in noise levels.

No indirect adverse effects from visual intrusions associated with Alternative 3 are anticipated, as the ranges are within an existing military operations area and the action would not involve a change in visual setting.

Access to all sites within the PIIA would be restricted during range operations; however, most of these sites are located within areas that currently have limited access due to operations at NAVMAG or their remote locations. Members of the public have requested to visit Almagosa Springs and other areas of NAVMAG in the past and there is a process to access certain areas. Therefore, indirect impacts could result from additional restrictions on access to five potential TCPs: Bona Springs (which is also within the PDIA), Almagosa Springs, Dobo Springs, Almagosa Mountain, and a high density area of *latte* sites. The 2011 PA requires development of plans for regular public access to historic properties for DoD-controlled lands on Guam, subject to considerations including but not limited to public interest, public safety concerns and protocols, installation security, and emergency situations.

Summary of Impacts and Potential Mitigation Measures

Implementation of Alternative 3 could cause direct, adverse effects to 11 known NRHP-eligible archaeological sites. Potential indirect adverse effects could occur to 25 NRHP-eligible archaeological sites with *latte* components. Direct effects could occur to two unevaluated sites and one potential TCP, and indirect effects could occur to two potential TCPs. Five potential TCPs could also be indirectly affected due to restricted public access. In addition, culturally important natural resources could be directly impacted due to removal of limestone forest and savanna vegetation. If this alternative were selected, final assessments would be determined consistent with the procedures identified in the 2011 PA.

Adverse effects that could occur from construction and operation under this alternative would be less than under other alternatives (the greatest effects from construction would occur under Alternative 5, whereas the greatest effects from operation would occur under Alternative 5). See Table 5.7-1 for a comparison of cultural resources impacts and potential mitigation measures for each LFTRC alternative.

The 2011 PA, as discussed in Section 3.1.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. Broadly, the 2011 PA includes processes to share information, consider views of the public, and develop mitigation measures when historic properties are adversely affected. The 2011 PA provides measures for mitigating adverse effects to NRHP-eligible or listed archaeological sites, consulting on new projects and initiating additional identification efforts, and resolving impacts due to loss of access to potential TCPs or culturally important natural resources.

More specifically, the 2011 PA established a process for the review and analysis of potential effects to historic properties and other cultural resources for all alternative LFTRC locations. During October through December 2014, the DON consulted with the parties to the PA and the public on the TRRA, which provided information about cultural resources potentially affected by the LFTRC alternatives carried forward in the SEIS, consistent with PA Stipulation V.C. The TRRA provides information on potential adverse effects resulting from the construction and operation of the LFTRC alternative to support consultation with the PA parties and the public. The DON will take all comments into account before reaching a final decision. For any alternative selected in the ROD, the 2011 PA stipulates that a RMP will be prepared to address effects from the construction and operation of the ranges. The RMP, developed in consultation with the consulting parties, will stipulate measures to avoid, minimize, and mitigate adverse effects to historic properties.

To the degree possible, direct and indirect impacts to historic properties and other resources of cultural importance would be avoided or minimized during the planning process. Consultation under the 2011 PA

would address potential adverse effects and alternatives to avoid adverse effects. Refer to Section 3.10 for more information on definitions and procedures. If avoidance is not possible, Table 5.3.10-6 presents potential mitigation measures to resolve adverse effects to historic properties and reduce direct and indirect, short- and long-term impacts to cultural resources resulting from the implementation of Alternative 3. With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that impacts could be reduced to a level below significance.

Table 5.3.10-6. Potential Mitigation Measures for Alternative 3 for Adverse Effects (NHPA) and Impacts to Other Cultural Resources (NEPA)

NHPA Effects	*Mitigation*
Potential direct adverse effects to 11 historic properties--NRHP-eligible archaeological sites from construction and potential indirect adverse effects to 25 NRHP-eligible sites from changes in use that degrade site integrity.	Development and implementation of the RMP to identify specific measures to avoid, minimize, and mitigate direct and indirect adverse effects to historic properties.
Potential indirect effects to five potential TCPs from restricted access.	Development of an RMP public interest, public safety, and installation security for access to these possible culturally sensitive locations.
Undetermined effects to 2 unevaluated sites and 1 potential TCP within the PDIA and undetermined effects to 5 potential TCPs from restricted access and 2 potential TCPs from exposure to an increase in noise.	If this alternative is selected in the ROD, unevaluated properties that may be affected would be evaluated consistent with the 2011 PA. If determined eligible for listing in the NRHP, appropriate mitigation measures would be developed to resolve any adverse effects.
Potential impacts to culturally important natural resources.	Through the 2011 PA process, coordinate with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans to provide an opportunity to collect these resources consistent with installation security instructions and safety guidelines.

5.3.11 Visual Resources

5.3.11.1 Affected Environment

The 2010 Final EIS describes the proposed activities to occur at NAVMAG (Volume 2, Chapter 2: Proposed Action-Training Functions, Section 2.3.1.3: Non-Firing General Military Skills Training Facilities, page 2-49). Although Alternative 3 differs from the 2010 Final EIS activities at NAVMAG, the potentially affected visual environment and the visual resources themselves would remain the same. A list and description of visual resources at the NAVMAG are provided in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.1.4.1: Naval Munitions Site, pages 13-54 to 13-57). See Section 4.3.11 of this SEIS for a summary of the visual resources at NAVMAG.

5.3.11.2 Environmental Consequences

Unlike Alternative 2 described in Section 5.2.11 above, Alternative 3 would involve the construction of up to four live-fire ranges and a range maintenance building 3 miles (5 km) north of Mount Lamlam and 4 miles (6 km) north of the publicly accessible Jumullong Manglo Overlook. The Alternative 3 facilities would possibly be visible from these public areas, as well as from the trails leading up to them.

Construction

During construction, activities and equipment would temporarily cause view obstructions where recognized views currently exist. These direct visual impacts during the construction phase would be short-term and would be less than significant.

Operation

The public viewing areas would be separated from the Alternative 3 facilities by a distance of 3 to 4 miles (5 to 6 km) with a substantial amount of topography in between. However, the elevation of both Mount Lamlam (the highest point on Guam and a National Natural Landmark) and Jumullong Manglo Overlook could present views of Alternative 3 structures, 3 miles (5 km) of new roadways, areas of removed vegetation, cut/fill features, and earthen berms. The direct long-term impact on visual resources viewable to the public from Mount Lamlam, Jumullong Manglo Overlook, and other vista points where the interior of NAVMAG would be altered, would be significant, given the large amounts of vegetated landscape and components of the scenic vista that would be altered and acquire a more developed appearance as a result. Potential mitigation measures to reduce this impact to less than significant are the following:

- To maintain the existing visual appearance, land clearing and grading should be minimized to the extent possible on lands proposed for range uses.
- Minimize impact by using native flora to create a natural-appearing "screen" around the cleared range areas, outside of the firebreaks/perimeter roads.

Alternative 3 would have a greater impact to visual resources than Alternatives 1, 2, and 5 because of the potential long-term ability to see the new structures from public viewing areas. Alternative 3 would also have a greater impact than Alternative 4, because more of the new roadway and ordinance magazines may be visible.

The level of significance of visual resource impacts resulting from implementation of Alternative 3 would be the same as those of Alternatives 1 and 4, and greater than the impacts of Alternatives 2 and 5.

5.3.12 Ground Transportation

5.3.12.1 Affected Environment

The affected environment for ground transportation resources Alternative 3 includes transportation facilities internal to the site (range roadways and intersections). This section discusses existing conditions and assesses how construction and operations of Alternative 3 would potentially affect transportation conditions for roadways and intersections internal to the site. Impacts to off-base (external) roadways and intersections are summarized in Section 6.1 of this SEIS.

5.3.12.2 Environmental Consequences

Construction

Potential construction impacts to ground transportation under Alternative 3 would be similar to those discussed in Section 4.1.12.2 for Alternative A. Potential direct and indirect impacts to ground transportation resources from construction would be minimized with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, there would be less than significant direct short-term impacts to on-base (internal) roadways.

Operation

Proposed access to Alternative 3 would be from the existing NAVMAG Main Gate located on Route 5. Existing roadways would be used wherever possible. However, this alternative requires the construction of an access road to allow all-weather operations, as well as a total of approximately 3.0 miles (5.0 km) of internal roadways, which would be required to support LFTRC operations. Potential operational impacts for Alternative 3 would be the same as those described in Section 5.1.12.2 for Alternative 1, and there would be no direct, long-term significant impacts to internal (range) roadway segments or intersections.

5.3.13 Marine Transportation

5.3.13.1 Affected Environment

The Alternative 3 and SDZ would not extend over open waters used by vessels. Thus, there would be no marine transportation in the proposed area.

5.3.13.2 Environmental Consequences

Implementation of Alternative 3 would not impact open waters used by vessels. Therefore, it is expected that there would be no impact to marine transportation due to the construction and operation of Alternative 3.

5.3.14 Utilities

5.3.14.1 Affected Environment

Existing utilities in the vicinity of the proposed HG Range are the same as discussed in Section 5.1.14.1 for Alternative 1.

Electrical Power

The electrical utility near the Alternative 3 consists of the existing DoD local power distribution system serving the existing NAVMAG facilities. This system includes power lines and transformers. The system is 3-phase 13.8 kV service.

Potable Water

The potable water system near Alternative 3 includes the local DoD water distribution system buried underground, the DON water treatment plant, Fena Reservoir, and water transmission lines from the water treatment plant to the DoD water system. The transmission lines mainly serve Naval Base Guam Apra Harbor. However, other DoD installations and the GWA typically also receive potable water from this source.

Wastewater

The wastewater utility near Alternative 3 consists of DoD wastewater collection systems buried underground in the existing NAVMAG area.

Solid Waste

There are no solid waste facilities near Alternative 3. The existing NAVMAG area is served by JRM contractors for solid waste pickup, handling, and disposal.

Information Technology and Communications

There is existing DoD IT/COMM infrastructure near Alternative 3 consisting of buried communication lines. No commercial IT/COMM lines are within the areas of Alternative 3.

5.3.14.2 Environmental Consequences

Potential impacts to existing utilities from operation of the HG Range would be the same as discussed in Section 5.1.14.2 for Alternative 1.

Electrical Power

The proposed electrical system improvements for Alternative 3, as described in Sections 2.5.4.3 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The electrical power requirements of the LFTRC facilities would be small (50 kW). During construction, there would be direct, short-term impacts on current customers consisting of potential limited power outages during construction. Power outages would be addressed through construction phasing or the use of temporary generators where necessary, which would minimize downtime.

The direct short- and long-term impact of Alternative 3 on the electrical utility would be less than significant, both during construction and in operation.

Potable Water

The proposed water system improvements for Alternative 3, as described in Sections 2.5.4.3 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The Range Maintenance Building and the KD Rifle/KD Pistol Range Administrative Building are the only LFTRC facilities requiring water service. A fire hydrant would also be provided for filling range fire fighting vehicles and general fire protection. The long-term potable water demand of the LFTRC would be small, estimated at an average daily demand of 26,520 gallons per day (100,389 liters per day). Therefore, less than significant direct, long-term impact would occur to the current DoD system. During construction minor, short-term water service outages could occur as new water lines are connected to existing water lines. With careful planning these potential outages would be minimized.

The direct short- and long-term impact of Alternative 3 to the potable water utility would be less than significant, during both during construction and in operation.

Wastewater

The proposed wastewater collection system improvements for Alternative 3, as described in Sections 2.5.4.3 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The only LFTRC facilities requiring sewer service would be the Range Maintenance Building and the KD Rifle/KD Pistol Range Administrative Building that would have an estimated wastewater flow of 0.01 MGd (0.038 MLd). A new sewer line would be installed and tied into the existing sewer line within the NAVMAG area to serve the Range Maintenance Building. The estimated long-term wastewater demand for this facility is minimal and there would be minimal long-term, direct impact on the existing sewer collection or treatment systems. Any outages to service during construction would be kept both minimal and short-term by doing tie-in work at low flow times, providing bypass lines and pumps, and by careful planning and design of the tie-in methods.

All other LFTRC facilities, including the HG Range, would be provided with portable toilets. These toilets would require periodic emptying, with the sewage then being taken to one of the existing WWTPs for treatment. The estimated long-term sewage amount is minimal and would not directly impact the current wastewater utility.

The direct short- and long-term impact of Alternative 3 to the wastewater utility would be less than significant, both during construction and in operation.

Solid Waste

The proposed solid waste infrastructure improvements for Alternative 3, as described in Sections 2.5.4.3 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The

long-term estimated solid waste generation for LFTRC operations is small and this additional solid waste would not directly impact current waste collection, handling, or disposal operations. Suitable solid waste collection containers would be provided where required. The solid waste would be periodically collected, handled, and disposed; as currently done by JRM contractors, who would add these containers to their pickup schedule.

Short-term, direct impacts to the solid waste handling effort during the U&SI phase involving the generation of green waste and C&D waste would be the same as discussed in Section 5.1.14.2 for Alternative 1.

The direct short- and long-term impact of Alternative 3 on the solid waste utility would be less than significant, both during construction and in operation.

Information Technology and Communications

The proposed IT/COMM infrastructure improvements for Alternative 3, as described in Section 2.6, have been developed to meet the requirements for the proposed action. There is one existing DoD IT/COMM line that underlies the proposed location for the MRF Range. This line would require rerouting during construction of the MRF Range. This would cause a short-term, temporary loss of service during switchover from the existing line. With careful planning the loss of service would be minimized. New conduit duct banks that would be required for Alternative 3 include six 4-inch (10-cm) conduits to interconnect the LFTRC range facilities with the HG Range. There would also be inter-base connectivity required for DoD IT/COMM, as discussed in Section 2.6. Some of these inter-base connections in the southern part of Guam would require new rights of way.

The direct short- and long-term impact of Alternative 3 on the IT/COMM utility would be less than significant, both during construction and in operation.

5.3.15 Socioeconomics and General Services

Most issues and impacts associated with socioeconomics and general services encompass the entire proposed action (i.e., cantonment/family housing and LFTRC development, and increased population), and do not vary with site alternatives. Accordingly, the impact discussion in Section 4.1.15 of this SEIS applies for all of the LFTRC alternatives and is incorporated here by reference. Land acquisition however is unique to the LFTRC alternatives, and the amount of land to be acquired varies by alternative. Therefore, this section focuses exclusively on the socioeconomic and sociocultural issues and impacts associated with the acquisition of land under Alternative 3 (with the exception of the HG Range, which would not require land acquisition).

5.3.15.1 Affected Environment

Table 5.3.15-1 displays baseline data for land that would be acquired for Alternative C. A total of 252 acres (102 ha) of land would be acquired by the federal government. Most of the land (156 acres, 63 ha) is privately owned, including at least four of the 23 lots that would potentially be acquired. GovGuam owns 46 acres (19 ha) spread over two lots. Seventeen lots that would be acquired have unknown ownership.

Table 5.3.15-1. Potential Changes due to Land Acquisition, NAVMAG (North/South) - Alternative 3

	Acres (ha)
Potential Increase in Federal Land	252 (102)
Private Land Potentially Acquired	156 (63)
GovGuam Land Potentially Acquired	46 (19)
Guam Ancestral Land Commission Land Potentially Acquired	0
Chamorro Land Trust Commission Land Potentially Acquired	0
Unknown Ownership Land Potentially Acquired	51 (21)
	Lots
Number of Lots Potentially Acquired	23
GovGuam Lots Potentially Acquired	2
Guam Ancestral Land Commission Lots Potentially Acquired	0
Chamorro Land Trust Commission Lots Potentially Acquired	0
Private Lots Potentially Acquired	4
Unknown Lot Ownership	17

Table 5.3.15-2 shows existing land use in the NAVMAG (North/South) acquisition area. Land use on the NAVMAG (North/South) parcel consists of 252 acres (102 ha) of undeveloped land. The GBSP land classification for the entire acquisition area is Agriculture. However, as described in the Land Use Section 5.3.6, no current agricultural use was identified. None of the acreage currently has a productive economic use.

Table 5.3.15-2. Existing Land Use - NAVMAG (North/South) - Alternative 3

Type of Land Use	***Acres (ha)***	***% Total Acreage***
Undeveloped Site in Natural State	252 (102)	100%

With regard to the affected fiscal environment of Guam, as stated in Section 5.1.15, GovGuam collected a total of $20.1 million in property tax revenues. These revenues accrue to the GovGuam general fund.

5.3.15.2 Environmental Consequences

The DON is required to comply with federal land acquisition laws and regulations, which include the requirement to offer just compensation to the owner, to provide relocation assistance services and benefits to eligible displaced persons, to treat all owners in a fair and consistent manner, and to attempt first, in all instances, acquisition through negotiated purchase. Specific policies and procedures, including the Uniform Act, are described in detail in Section 5.1.15.2.

While the government is authorized to acquire property through its powers of eminent domain (condemnation), it has been the consistent policy of the DON to acquire real estate through negotiation with owners. Even with a negotiated sale or lease however, "friendly" condemnation may be necessary to clear problems with title. The DON would comply with all applicable laws and regulations, including the Uniform Act.

In general, assuming voluntary sale or lease of property and conformance with land acquisition laws and regulations, land acquisition impacts from both a socioeconomic and sociocultural perspective would not be considered significant. Should condemnation be necessary as a last resort, while the landowner would be made economically whole by payment of fair market value, such an occurrence could represent an adverse sociocultural impact for that individual landowner. Such instances are expected to be extremely

rare or nonexistent during implementation of this proposed action, and collectively would not represent a significant impact.

Socioeconomic and Sociocultural Impacts

Potential impacts associated with land acquisition could affect individual property owners, occupants, the surrounding community, and GovGuam. Economic impacts presented in this section are total impacts. They include impacts that would be generated by the proposed action both directly and indirectly. Individual owners and occupants might be impacted from an economic perspective or a sociocultural perspective. Economic impacts associated with land acquisition are those that are purely financial. Sociocultural impacts associated with land acquisition are less tangible and are based on conceptual frameworks such as social disarticulation and cultural marginalization (the deterioration of social structures, networks, or belief systems), and social and psychological marginalization, stress, and anxiety (a person's loss of confidence in society and themselves, feelings of injustice, and reduced social status). See Appendix D, Section 5.2.2 for more detail.

Individual Owner/Occupants

With regard to economic impacts, if acquisition of privately-owned lots were to occur through negotiated purchase with the owners, there would be no adverse impact. As required under the Uniform Act, the purchase would take place at fair market value. Conversely, if the property was acquired through condemnation the federal government would still be required under the Uniform Act to reimburse the property owner at the fair market value. Therefore, the land acquisition would not cause an adverse economic impact to individual landowners.

With regard to sociocultural impacts, this alternative would require the acquisition of 23 separate lots, including two lots owned by GovGuam. Of the lots required, four are known to be privately owned and 17 lots have unknown ownership, so up to 21 different private parties could be affected. It is anticipated that, in all cases, a negotiated sale or lease between the federal government and a willing seller would be arranged, and there would be no adverse sociocultural impact. In the unlikely event that the land was acquired through condemnation, it is possible that the individual landowner would potentially consider the forced sale or lease of property to be an adverse impact (despite being paid fair market value).

Community

With regard to economic impacts, the NAVMAG (North/South) lands are undeveloped in a natural state (see Table 5.3.15-2), and no current agricultural activities or other economically productive land uses were identified. Because the land that would be acquired does not currently have an economically productive use, and the fair market value would account for the highest and best use, there would be no adverse economic impact.

With regard to sociocultural impacts, the addition of an estimated 252 acres (102 ha) of federal land on Guam would be considered by some citizens to be an adverse impact due to the current extent of federal land that is under DoD custody and control (25.9% of all land on Guam, see Section 5.1.15), which would increase to 26.1% with acquisition of the NAVMAG North/South parcel. However, because of the DON's commitment to the concept of "net negative," by the end of the Marine Corps relocation there would be no net increase in federal land under the custody and control of the DoD.

Five recreational sites are located in the vicinity of Alternative 3 (see Section 5.3.7). Four of the five recreational sites are located on NAVMAG and are only open to installation personnel and their guests. The remaining recreational site, Talofofo Falls Park and Hiking Trail, is accessible to the public along the

existing access road between Route 4 and the Dandan Communication Site and is not located within the land acquisition boundary. Although access to Talofofo Falls Park and Hiking Trail may be temporarily affected during construction activities along the access road, the proposed construction activities along the access road would be short-term in duration, and associated direct sociocultural impacts would be less than significant.

Government of Guam

The current 156 acres (63 ha) of land in Alternative 3 that are privately owned are subject to GovGuam property tax. The average per acre value for these parcels is $206,911. The total tax base for private lands is estimated to be $32.3 million ($206,911 x 156 acres). On this property, land owners pay an estimated $27,436 in property taxes to GovGuam. Acquisition of this property by the federal government would represent a loss of 0.14% of FY 2011 GovGuam property tax revenues, representing an adverse but less than significant impact.

GovGuam owns 360 acres (146 ha) of the land subject to acquisition under this alternative. At present, this land is not developed, leased or otherwise generating income for GovGuam. As such, either a sale or lease would generate a direct small beneficial economic effect (though less than significant in magnitude).

5.3.16 Hazardous Materials and Waste

5.3.16.1 Affected Environment

The current DoD ROI on Guam for hazardous materials and waste in this section includes Navy property proposed for development of a LFTRC. Navy property includes undeveloped lands located in the northwest portion of the NAVMAG site, the western perimeter of the SDZ boundary and an additional area northwest of the Fena Valley Reservoir.

Hazardous Material and Hazardous Waste Management

The affected environment or present conditions at NAVMAG with regards to hazardous materials and hazardous waste management would be the same as described in Section 3.16.1 of this SEIS, which provides a summary of hazardous materials, hazardous waste, toxic substances, and contaminated site information pertinent to Guam. Currently there are three hazardous waste accumulation sites (NAWMU-1, B-870, NMC-EAD, B-901 and B-740, Ordnance) and two less-than-90 day storage areas (585B U.S. Navy Lab and B-404) located at NAVMAG (NAVFAC Pacific 2013c).

Contaminated Sites

Installation Restoration Program Sites

One IRP site, Site 35 - Tear Gas Burial Site, is located along the western boundary of the NAVMAG site and is in the vicinity of an area proposed for development for a live-fire training range complex under Alternative 3 (Figure 5.3.16-1). This IRP site was determined to have no effect on proposed NAVMAG site conditions (NAVFAC 2012).

Military Munitions Response Program

One MMRP site, UXO 3 NAVMAG Small Arms Range, was identified in the area of NAVMAG proposed for development of this LFTRC alternative. This active site is described in detail in the 2010 Final EIS (Volume 9, Appendix G: EIS Resource Technical Appendix, Chapter 3: Hazardous Materials and Waste Resources, Section 3.5: South, Table 3.6-5: Summary of Active Hazardous Waste Sites in South Guam, page G-3-53). This MMRP site was determined to have no effect on proposed NAVMAG site conditions (NAVFAC Pacific 2010a).

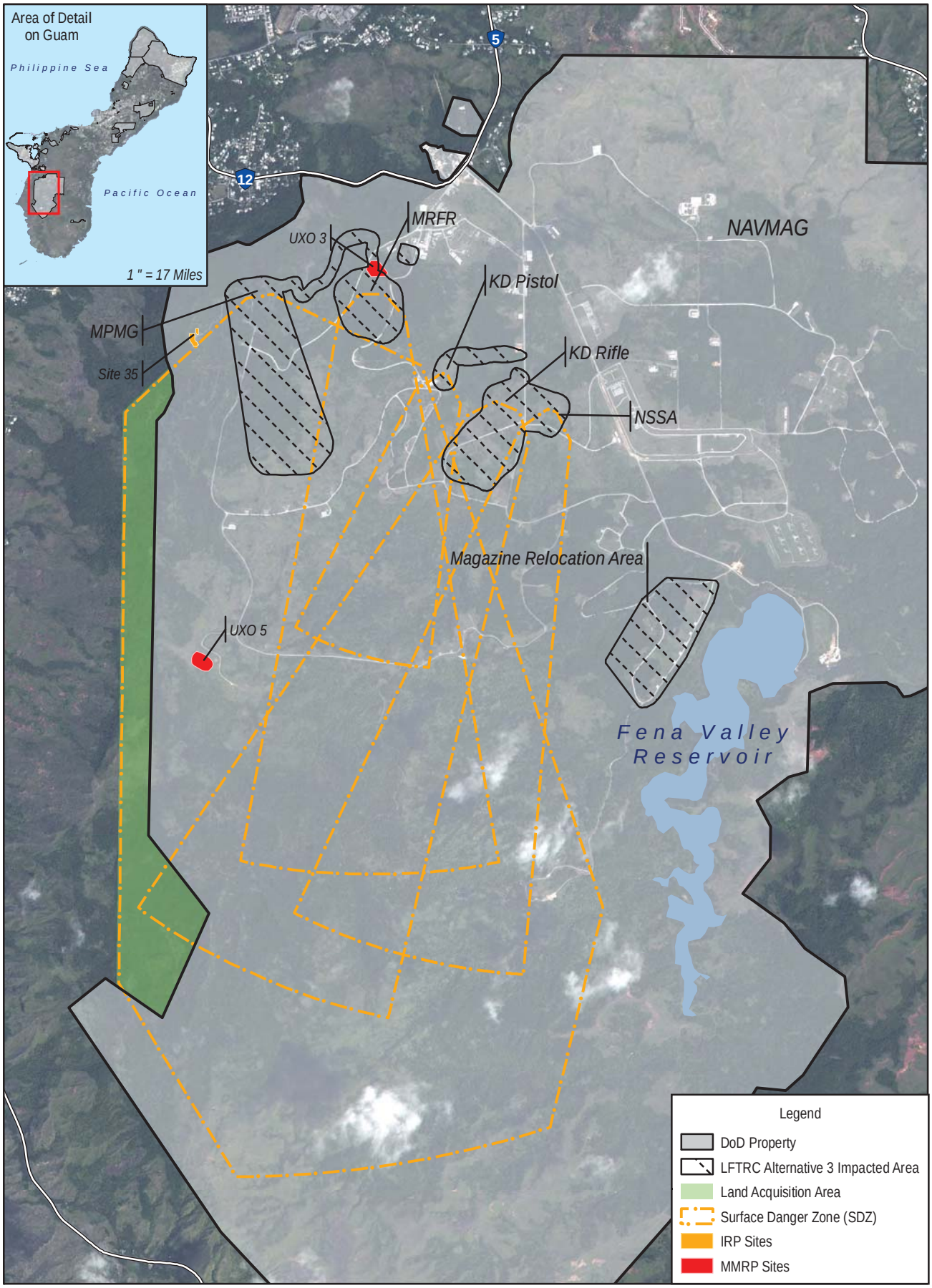


Figure 5.3.16-1
Active and Restricted IRP Sites and MMRP Sites within NAVMAG (North/South) LFTRC Alternative 3

Source: NAVFAC Pacific 2013

Toxic Substances Management

Currently, portions of the area that would be affected by the proposed LFTRC development contain magazines for the storage of various munitions. Any structure constructed prior to 1978 may contain LBP, ACM and PCBs.

According to USEPA, the parcel is located in an area classified as Zone 3 for radon, indicating average indoor radon levels of less than 2 pCi/L.

5.3.16.2 Environmental Consequences

Construction

Hazardous Materials and Waste

Construction activities would result in a short-term increase in the use of hazardous materials, and generation of hazardous waste that would cease at the completion of construction activity and would be the same as described in Section 5.1.16.2 of this SEIS. Should there be a need to import off-island earthen materials, all GEPA, Department of Agriculture, and local rules and regulations would be followed. Due to the short-term nature of the construction activity and the limited amount of hazardous materials and waste that would be generated, direct or indirect impacts would be less than significant.

Contaminated Sites

No contaminated sites were identified on the subject property. Therefore, no direct or indirect impacts to contaminated sites from construction activities would occur.

Toxic Substances

Demolition and construction activities associated with this alternative would have less than significant impacts on toxic substances. The demolition of magazines may result in encountering PCBs, ACM and LBPs that were used in the older building materials. If PCBs, ACM, and/or LBPs are encountered during demolition, licensed contractors would be used for these projects to ensure that all DoD, federal, state, and local PCBs, ACM, and LBP testing, handling, and disposal protocol, procedures, and requirements are followed. Toxic substances would not be utilized for new construction. LBPs were banned by USEPA in 1978 and most uses of PCBs were banned by USEPA in 1979. Although not a banned substance, ACM would not be used to construct proposed new facilities on Guam. Because the proposed construction areas are located in a USEPA Radon Zone 3, it is unlikely that new buildings, facilities and structures would encounter radon intrusion. No direct or indirect impacts would occur and no potential mitigation measures may be required.

Operation

Hazardous Materials

Live-fire training ranges would generate a long-term increase in the release of hazardous materials from expended training materials resulting from proposed new training operations and would be similar to those described in Section 5.1.16.2 of this SEIS. However, because the training ranges and associated SDZs would be land-based, there would be no direct impacts to open waters. As described in Section 5.1.16.2, direct or indirect impacts would be less than significant.

Hazardous Waste

Operation of the live-fire training ranges would result in a long-term increase in the generation of hazardous waste and associated impacts would be the same as described in Section 5.1.16.2 of this SEIS. As described in Section 5.1.16.2, direct or indirect impacts would be less than significant.

Contaminated Sites

No contaminated sites were identified on the subject property. Therefore, no direct or indirect impacts to contaminated sites from increased Marine Corps range training activities would occur.

Toxic Substances

When assessing the transport, transfer, and future use of toxic substances associated with the development of firing ranges on Guam, no significant environmental consequences from ACM, LBP, and PCBs are anticipated. This is because LBPs were banned by the USEPA in 1978 and most uses of PCBs were banned by the USEPA in 1979. In addition, ACM and gases would not be transported or transferred as a result of these activities. Existing BMPs and SOPs (2010 Final EIS, Volume 2, Chapter 17: Hazardous Materials and Waste, Section 17.2.2 Alternative 1, Table 17.2-3: Summary of BMPs and SOPs, pages 17-141 to 17-43 and Volume 7, Chapter 2: Overview of Best Management Practices and Mitigation Measures, Section 2.1: Best Management Practices on Guam and Tinian, Table 2.1: Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23) and summarized in Chapter 2 of this SEIS would be followed to the maximum extent practicable. Adherence to applicable BMPs (e.g., erosion control, routine inspections, employee training) would reduce the likelihood and volume of accidental releases from site disturbance and enable timely implementation of cleanup measures, thereby minimizing potential impacts to the environment. Because the proposed construction areas are located in a USEPA Radon Zone 3, it is unlikely that new buildings, facilities and structures would encounter radon intrusion. Toxic substances direct or indirect impacts would be less than significant during operations.

5.3.17 Public Health and Safety

5.3.17.1 Affected Environment

Operational Safety

To protect the general public from intentional or accidental entry onto NAVMAG property, locked or manned gates are used where vehicle access is provided and a series of warning signs cautioning personnel not to enter the area are posted along the perimeter of the installation. Unauthorized personnel are not allowed on the installation at any time.

A small arms range and sniper range are present on the west-central portion of NAVMAG. In addition, an emergency demolition range is present in the central portion of NAVMAG, west of the Fena Valley Reservoir. Both of these ranges are within the SDZ footprint for Alternative 3. Activities at these ranges are conducted in accordance with SOPs to ensure the safety of both range participants as well as the general public.

The munitions operations and storage area and the emergency demolition range on NAVMAG have associated ESQD arcs that restrict the construction of inhabited buildings and other non-munitions related activities to minimize potential impacts on personnel and the general public from an explosive mishap. Explosives handling and storage is the primary function within the munitions storage area. Detonation of UXO in emergency situations is the primary function of the emergency demolition range.

Environmental Health Effects

Aviation training is limited to four helicopter landing zones at NAVMAG. Landing Zone 1 is within the proposed SDZs associated with Alternative 3 development, and is used in airborne raid-type training, along with an adjacent breacher house. The overflight of helicopters produces noise. However, this training is infrequent and occurs at locations within the installation away from populated areas, resulting in no community noise effect. In addition, a small arms range and sniper range are internal to the installation and do not present a current noise management issue.

Land demolition activities take place at the NAVMAG demolition range in the central portion of the installation (approximately 4,100 feet [1,250 m] from the closest public boundary). Although individuals exposed to these noise events may be startled if they are unaware of the source of the noise, the brevity and relative infrequency of activities does not result in noise contours extending onto adjacent public lands. Details regarding current noise conditions at NAVMAG are provided in Section 5.3.4.1.

Water Quality

The Fena Valley Reservoir, which is the primary drinking water source for the southern portion of Guam, is within the NAVMAG boundary. Water quality from the Fena Valley Reservoir and regional springs is generally high, requiring minimum treatment and chlorination for domestic use. Threats to water quality include sedimentation from accelerated erosion, eutrophication because of persistent conditions of low dissolved oxygen, and fecal material contamination from deer, feral animals, and other animals (DON 2010a). Section 5.3.2.1 provides details regarding current quality of potable water sources.

Hazardous Substances

Management practices and contingency plans for the use, handling, storage, transportation, and disposition of hazardous substances associated with NAVMAG ensure that exposure to the environment and human contact is minimized.

The IRP focuses on cleaning up releases of hazardous substances that pose risks to the general public and/or the environment. The MMRP focuses on identifying and removing MEC. U.S. Naval Activities Site 35 (Tear Gas Burial Site) is situated west of the proposed MPMG live-fire training area but does not directly affect the Alternative 3 development. Contaminants of concern at this site include polynuclear aromatic hydrocarbons. Land use controls are in place at this site. A small arms range and sniper range (MMRP Site UXO 3) are present on the west-central portion of NAVMAG. In addition, an emergency demolition range is present in the central portion of NAVMAG, west of the Fena Valley Reservoir. Activities at these ranges are conducted in accordance with SOPs to ensure the safety of range participants as well as the general public. The hazardous materials and waste section of this SEIS (see Section 5.3.16) provides additional detail for the status of IRP and MMRP sites.

Unexploded Ordnance

The presence of UXO within the Alternative 3 area is unknown. However, Guam was an active battlefield during WWII. As a result of the occupation by Japanese forces and the subsequent assault by Allied/American forces to retake the island, unexploded military munitions may still remain.

Traffic Incidents

No high crash frequency locations have been identified in the vicinity of the Alternative 3 area.

5.3.17.2 Environmental Consequences

Potential impacts on public health and safety from implementation of Alternative 3 would be similar to those discussed for Alternative 2 (see Section 5.2.17).

Operational Safety

Construction Safety

Potential impacts from construction safety would be similar to those discussed for Alternative 2. During construction activities, a health and safety program would be implemented by the construction contractors based on industry standards for accident and pollutant release prevention. Because a health and safety program would be implemented for construction activities and the general public would be excluded from entering construction areas, potential short-term construction impacts on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to construction activities is anticipated.

Operation/Range Safety

To protect the general public from intentional or accidental entry onto live-fire training ranges, a series of warning signs cautioning unauthorized personnel not to enter the area would be posted along the perimeter of the installation as well as at the range area. Unauthorized personnel would not be allowed on the installation or range at any time.

SOPs require that before conducting training activities, the general public and non-participating personnel would be cleared from the area so that the only public health and safety issue would be if a training event exceeded the safety area boundaries. Risks to public health and safety would be reduced by confirming that the training area is clear. The Range Safety Officer would ensure that hazardous areas are clear of personnel during training activities. After a live-fire event, the participating unit would ensure that weapons are safe and clear of live rounds.

Use of established training areas and compliance with appropriate range safety procedures would reduce the potential for interaction between the general public and personnel that are training. Specific and documented procedures would be in place to ensure the general public is not endangered by training activities. Therefore, Alternative 3 would result in no direct or indirect impact on public health and safety from operations and training activities.

Explosive Safety

Ordnance used at Alternative 3 would be handled, stored, and transported in accordance with Marine Corps explosive safety directives (MCO P8020.10A, *Marine Corps Ammunition Management and Explosives Safety Policy Manual*), and munitions handling would be carried out by trained, qualified personnel. For the proposed LFTRC under Alternative 3, SDZs have been defined for each of the ranges to identify the areas requiring control of unauthorized access to live-fire training operations. The SDZs established for Alternative 3 reflect a "worst case scenario" for weapons use to ensure the safety of on- and off-range personnel and civilians. The proposed layout of the SDZs is provided in Chapter 2. With implementation of appropriate range safety procedures, no direct or indirect impact on public health and safety is anticipated from Alternative 3 activities.

The munitions operations and storage area as well as the emergency demolition range on NAVMAG have associated ESQD arcs that restrict the construction of inhabited buildings and other non-munitions related activities, to minimize potential impacts on personnel and the general public from an explosive mishap.

The ESQD arcs overlay Alternative 3 firing positions and the associated SDZs. Because the ESQD arcs overlay proposed live-fire training firing positions and SDZs, a conflict between the current munitions storage and EOD range activities with the proposed live-fire training activities would occur. However, munitions magazine relocation is included in Alternative 3 to eliminate this conflict. An explosive safety review would be needed to ensure compatible development and use. In addition, SDZs for Alternative 3 activities encumber the existing breacher house, sniper range, emergency demolition range, Landing Zone 1, and a portion of the non-firing maneuver area resulting in a safety conflict between the use of these facilities/areas and the proposed live-fire training activities. Use of these facilities/areas would be prohibited when Alternative 3 is supporting live-fire training. The emergency destruction mission of the emergency demolition range would take precedence over Alternative 3 activities. As part of Alternative 3 development, munitions magazines would be relocated to eliminate both the conflict between proposed Alternative 3 live-fire training locations and existing ESQDs for current NAVMAG mission activities, as well as the conflict between SDZs and current NAVMAG facilities. No significant safety impacts (direct or indirect) would result if existing incompatible munitions magazines are relocated.

Environmental Health Effects

Noise

Potential impacts on public health and safety from Alternative 3 noise would be similar to those discussed for Alternative 2. Increases in noise emissions associated with implementation of the short-term construction phase of this alternative with identified BMPs would be less than significant. Enforcement of OSHA guidelines for hearing protection for workers would be the responsibility of the construction contractors. Noise from Alternative 3 activities (i.e., weapons firing) would be heard on adjacent lands from the range. Some adjacent lands north and west of Alternative 3 include residential uses. However, no people would be exposed to incompatible noise levels (see Section 5.3.4.2). Sound generated from Alternative 3 activities would not result in loss of hearing to nearby residents because no residences are located in incompatible areas. Based on the modeled noise for Alternative 3 activities (see Section 5.3.4), the overall direct or indirect impacts associated with noise on public health and safety would be less than significant.

Water Quality

Potential impacts on public health and safety from water quality concerns would be similar to those discussed for Alternative 2. Water withdrawal would likely increase. However, sustainability practices would be implemented to reduce the amount of water needed (see Section 5.3.2.2). The resulting total annual water withdrawal would be less than the sustainable yield, and monitoring of water chemistry would identify any emerging issues to ensure no harm to the water supply.

The Fena Valley Reservoir is within the NAVMAG boundary and is the primary drinking water source for the southern portion of Guam. The reservoir is located southeast of Alternative 3 and is outside established SDZs for live-fire training activities. The SDZs define the ground area needed to contain projectiles, fragments, debris, and components resulting from the firing, launching, and/or detonation of weapons. Because Alternative 3 activities would be contained within the designated SDZs, no direct or indirect impact on the Fena Valley Reservoir is anticipated.

Because measures would be taken to maintain a sustainable water supply and the Fena Valley Reservoir is outside the SDZs for Alternative 3 activities, public health and safety impacts from long-term increased demand on potable water and potential water-related illnesses would be less than significant.

Hazardous Substances

Potential safety impacts from use of hazardous substances would be similar to those discussed for Alternative 2. Implementation of this alternative would result in an increase in the use, handling, storage, transportation, and disposition of hazardous substances. These activities would be conducted in accordance with applicable hazardous material and waste regulations, and established BMPs and SOPs to ensure that the health and safety of workers and the general public is maintained. IRP and MMRP investigations and/or remediation activities, as necessary, would continue in an effort to clean up past releases of hazardous substances that pose a risk to the general public and the environment. Continued regulatory oversight and concurrence would ensure that necessary actions have been completed to ensure the safety of the general public. Because hazardous substance management and IRP/MMRP investigative/cleanup activities would be conducted in accordance with applicable regulations and established BMPs and SOPs, no direct or indirect impact on public health and safety is anticipated.

With regard to exposure to airborne toxic dust related to live-fire training activities and range maintenance, lead is the primary contaminant of concern. Very small lead particles can become airborne if wind, foot traffic, or maintenance activities disturb lead-contaminated soil. Firing ranges would be designed and constructed so that participating personnel are not exposed to airborne contaminants above permissible limits. The nearest residential population is located approximately 0.5 mile (0.8 km) to the north and emissions migrating off range would likely be much lower than on-site. Analysis of firing range emissions presented in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section: 5.2.7: Summary of Impacts, Table 5.2-8, page 5-36) indicated that operations emissions from firing range components would be well below significance criteria. Because range maintenance procedures ensure that participating personnel are not exposed to airborne contaminants above permissible limits and analysis of firing range emissions are below significance criteria, a less than significant direct or indirect impact on public health and safety from firing range activities is anticipated.

Unexploded Ordnance

Potential impacts from UXO would be similar to those discussed for Alternative 2. Excavation for building foundations, roads, underground utilities, and other infrastructure could encounter unexploded military munitions in the form of UXO, DMM, and/or MPPEH. Exposure to MEC could result in death or injury to workers, with the exception of public access provisions outlined through the 2011 PA process (see Section 4.4.10, Cultural Resources). The general public would be excluded from entering construction zones and training areas. To reduce the potential hazards related to the exposure to MEC, ESS documentation would be prepared that outlines specific measures that would be implemented to ensure the safety of workers and the general public. BMPs that would be implemented include having qualified UXO personnel perform surveys to identify and remove potential MEC items before beginning ground-disturbing activities. Additional safety precautions would include having UXO personnel supervision during earth-moving activities and providing MEC awareness training to construction personnel involved in grading and excavations before and during ground-disturbing activities. In addition, the DON provides MEC awareness training to GovGuam and other public representatives, allowing access to project sites to facilitate surveys and collection of natural resources or items of cultural significance prior to conducting vegetation clearance. Because UXO would be identified and removed before beginning construction activities, and construction personnel would be trained about the hazards associated with unexploded military munitions, potential direct or indirect impacts from encounters with UXO would be minimized and would be less than significant.

Traffic Incidents

Potential long-term traffic incident increases would be similar to those discussed under Alternative 2. The potential for increased traffic incidents is small (5% increase [see Section 4.1.17.2]). Because no high crash frequency intersections are located near NAVMAG, and the overall potential long-term increase in the number of traffic accidents as a result of the increase in personnel would be minimal, a less than significant impact is anticipated on the health and safety of the citizens of Guam from traffic incidents.

5.3.18 Environmental Justice and the Protection of Children

5.3.18.1 Affected Environment

The affected environment under the NAVMAG (North/South) alternative is considered to be the entire island of Guam, as discussed in Section 4.1.18.1 of this SEIS. The NAVMAG (North/South) proposed action under this alternative would be located within the southern region of Guam, as defined in Section 4.1.18.1. The villages of Santa Rita, Agat, Umatac, Talofofo, and Yona are within this region.

5.3.18.2 Environmental Consequences

Potential impacts to environmental justice populations from Alternative 3 would be to noise, recreation, land acquisition, and public health and safety. The impact analysis discussion provided in the following sections is focused primarily on operational impacts of implementing the proposed Alternative 3, as LFTRC construction impacts as related to environmental justice would be minimal and short-term, with no measurable effect on Guam's special-status populations.

Noise

The potential impacts for Alternative 3 would be the same as Alternative 2.

Recreation

While there are fewer public recreational resources in the south, there are several resources along the coast as described in Section 5.3.7. Potentially affected resources include Talofofo Falls Park and Hiking Trail.

In Alternative 3, only a small portion of the SDZ extends outside NAVMAG property and there are no recreational resources that would be impacted by use of this area for LFTRC activities. There would be less than significant impact to recreational resources during the construction phase. There would also be less than significant impact to recreational resources during the operation of this LFTRC.

Land Acquisition

There would be short and long-term, direct and indirect significant adverse impacts to land ownership if there is an unsolicited sale of privately-owned land to the federal government for Alternative 3. Although there may be landowners who are interested in selling their land, land ownership impacts are considered significant until negotiations have been completed. There would also be other relocation activity and land acquisition, or long-term leases for roadway improvements, to implement this alternative.

Tier 1: Are there any minority, low-income, or children populations that would be impacted?

Yes, based on the data provided in Section 4.1.18.1, the private landowners are likely to be racial minorities that live in areas with a higher poverty rate than the U.S.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?

No, because all of Guam is considered a racial and ethnic minority population, minorities would not experience disproportionately high and adverse effects due to land acquisition. Because federal regulations regarding land acquisition would ensure that significant economic impacts to landowners and occupants do not occur, low-income populations would not experience disproportionately high and adverse effects due to land acquisition. Land acquisition would not result in health and safety risks that would disproportionately impact children. Therefore, Alternative 3 would not result in disproportionate land use or socioeconomic impacts to minority and low-income populations or children as a result of land acquisition.

Public Health and Safety

No impacts to public safety are anticipated from operational safety concerns (i.e., explosive safety, electromagnetic safety, construction safety). No impacts to public health and safety are anticipated from management of hazardous substances. Less than significant impacts are anticipated to public health and safety from firing range air emissions. Less than significant impacts are anticipated from construction and operational noise, water quality, and UXO.

Tier 1: Are there any minority, low-income, or children populations that would be impacted?

Yes, the populations of the villages affected by Alternative 3 have high percentages of racial minorities, low-income groups, and children.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?

No, impacts would not be disproportionate because regardless of where the LFTRC is located on Guam, high (relative to the U.S.) percentages of minorities, low-income residents, and children would be affected. As LFTRC alternatives may only occur on Guam (by international treaty), and all of Guam is considered to have a high proportion of minorities, low-income residents, and children, impacts cannot be considered disproportionate.

5.4 NAVAL MAGAZINE (L-SHAPED) LIVE-FIRE TRAINING RANGE COMPLEX - ALTERNATIVE 4

Under Alternative 4, the proposed development of a live-fire training range complex would occur at NAVMAG L-Shaped. Details about this alternative are provided in Section 2.5.4.4 and the proposed site is illustrated in Figure 2.5-5.

5.4.1 Geological and Soil Resources

5.4.1.1 Affected Environment

The affected environment for the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.1.1 of this SEIS.

The affected environment for geological and soil resources associated with Alternative 4 is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.1.5: South, pages 3-26 to 3-28), which is summarized below for reference. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for geological and soil resources, but it would reduce some potential impacts to geological and soil resources that were determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, as described in the analysis of environmental consequences for Alternative 4 below.

This alternative combines the land areas of the other two NAVMAG alternatives. Therefore, Alternative 4 would be located in the same mountainous part of south-central Guam as Alternatives 2 and 3 (Figure 5.4.1-1). Elevations within Alternative 4 range from approximately 310 feet (95 m) above MSL in the southeast near the KD Rifle Range to approximately 700 feet (213 m) MSL to the MPMG Range in the northwest (Figure 5.4.1-2). Fena Valley Reservoir lies between the southeastern and northwestern extent of the proposed Alternative 4 footprint.

Bedrock in the northwestern portion of the Alternative 4 footprint (where the MPMG Range would be located) is old (Barrigada) limestone, the geologic setting for sinkholes (see Section 3.1.1.1). Based on available topographic and field data, three features have been preliminarily identified as sinkholes/depressions that may contain sinkholes within, or on the perimeter of, the proposed Route MPMG Range footprint and its associated range road in the northwestern portion of Alternative 4 (Figure 5.4.1-1). The remainder of the Alternative 4 footprint is underlain by bedrock of volcanic origin. One minor bedrock fault crosses the northwestern portion of the Alternative 4 footprint, and there are multiple faults in the surrounding area.

The soil types and their properties in the Alternative 4 footprint are the same as those described for Alternatives 2 and 3 (Figure 5.4.1-2). Briefly, for nearly all of the soil types in the Alternative 4 footprint, runoff is medium to rapid, and the water erosion hazard is moderate to severe (Young 1988). The exception is the Ritidian-Rock Outcrop Complex soil found in the northwestern corner of Alternative 4, for which runoff is very slow and the water erosion hazard is slight.

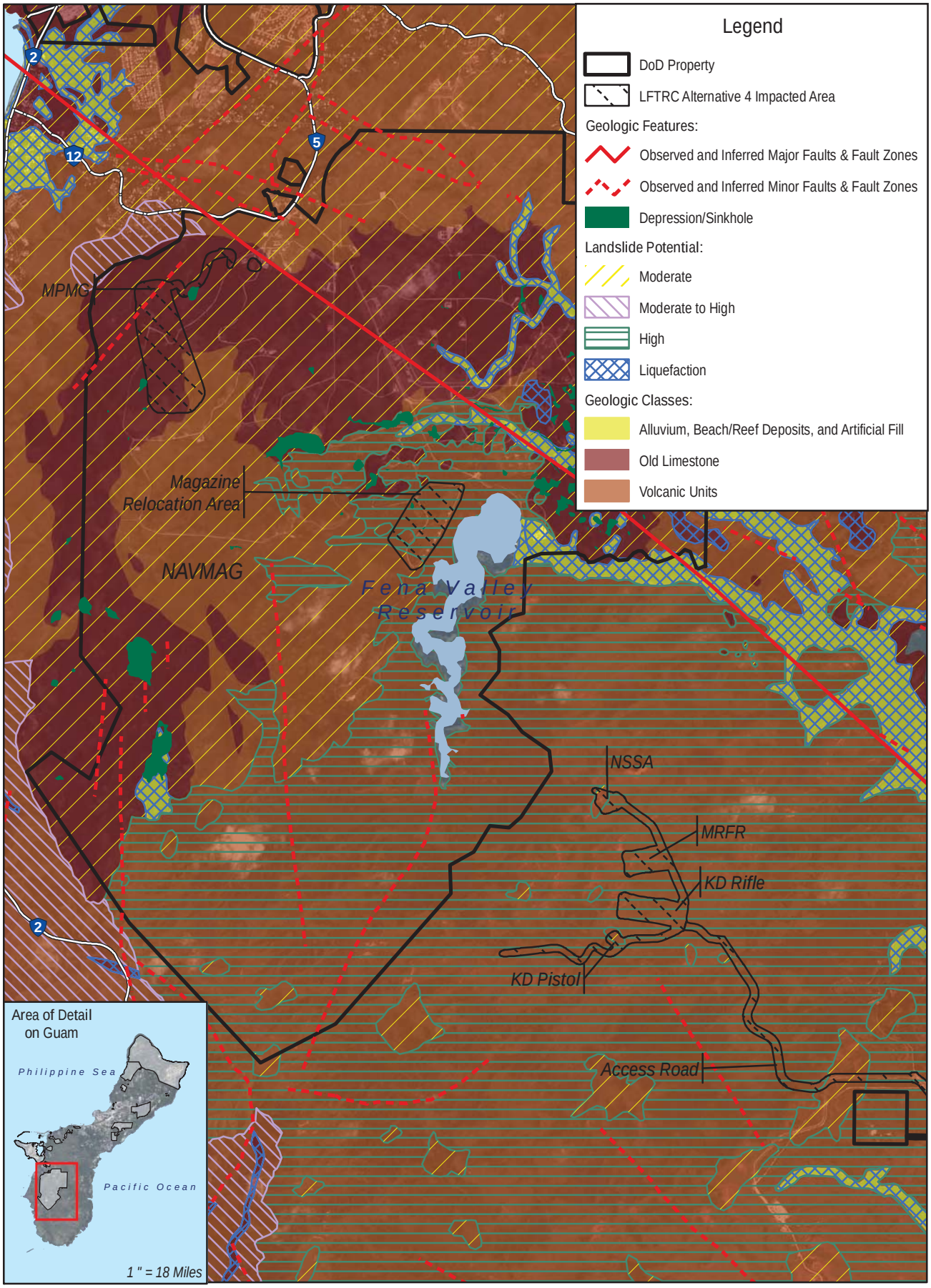


Figure 5.4.1-1
Geologic Features in the Vicinity of
NAVMAG (L-Shaped) LFTRC Alternative 4

Sources: COMNAV Marianas 2008; GovGuam 2008; NAVFAC Pacific 2013; WERI 2001

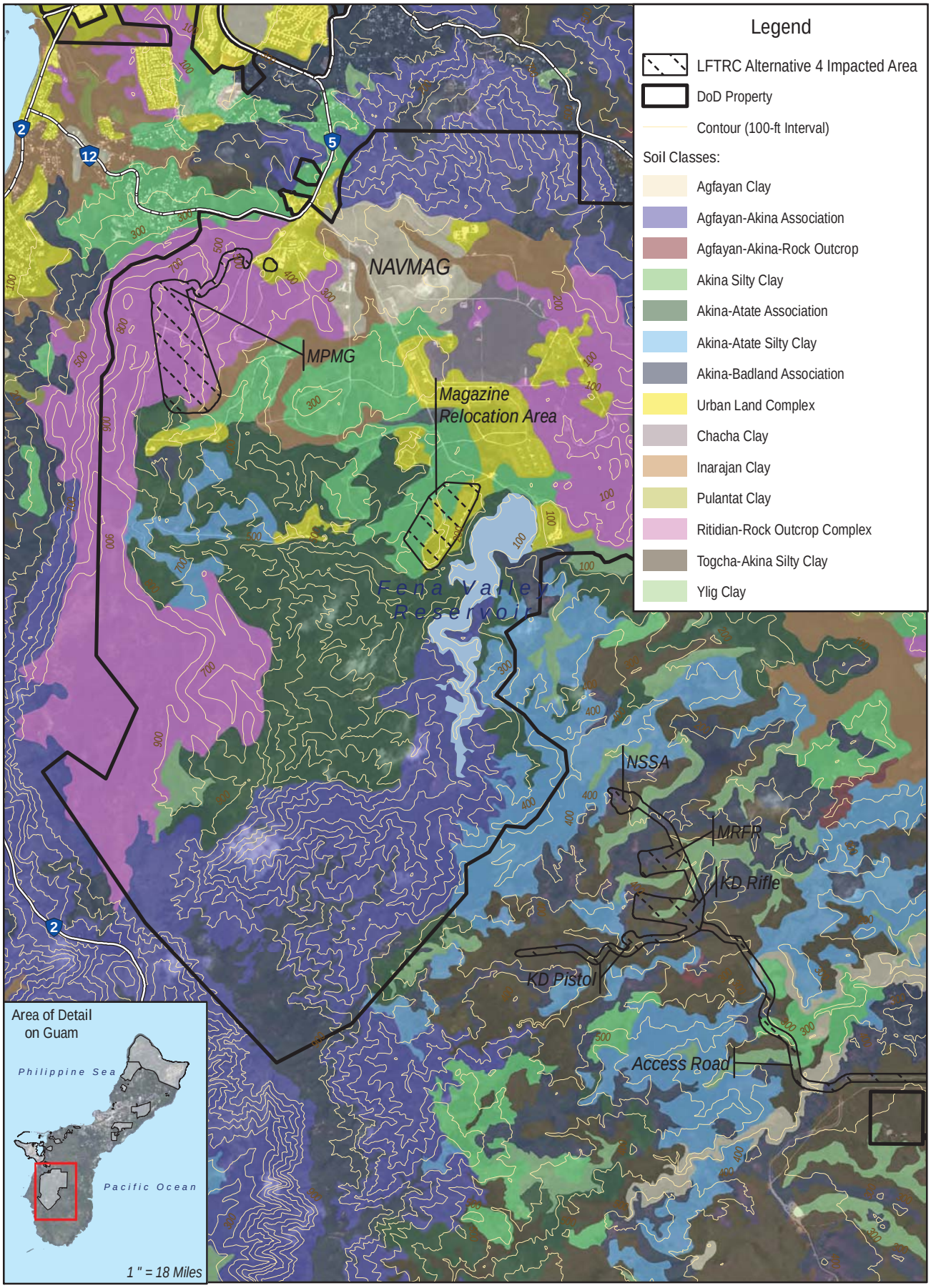


Figure 5.4.1-2
Soils in the Vicinity of
NAVMAG (L-Shaped) LFTRC Alternative 4

With respect to geologic hazards (see Section 3.1.1.1), most conditions at the proposed Alternative 4 location are the same as for Alternative 3 (i.e., consolidated bedrock underlying the site is not vulnerable to liquefaction; the site elevation is higher than the maximum recorded tsunami wave run-up; limestone bedrock the area of the Alternative 4 MPMG Range presents a potential hazard of surface instability and collapse due to sinkholes). Three features have been preliminarily identified as sinkholes/depressions that may contain sinkholes within, or on the perimeter of, the Alternative 4 footprint in limestone bedrock. The other Alternative 4 firing ranges and the Magazine Relocation Area would be located on volcanic bedrock, in which sinkholes typically do not form. In the northwestern portion of the site, where the MPMG Range would be located, the landslide potential is moderate. The southwestern portion where the other ranges would be located has a high landslide potential (see Figure 5.4.1-1).

5.4.1.2 Environmental Consequences

Construction

Potential geology and soil impacts addressed in this section are limited to elements of the proposed action that could affect onshore landforms or that could be affected by geologic hazards. Potential soil contamination issues are addressed in Section 5.4.16.2, Hazardous Materials and Waste of this SEIS.

Construction impacts associated with the HG Range at Andersen South would be similar to those described under Alternative 1 in Section 5.1.1.2 of this SEIS.

Construction activities for Alternative 4 would be the similar to those described for Alternative 3, except that an estimated 66 new concrete munitions magazines would be constructed as compared with 72 new magazines for Alternative 3. Earthwork would include 2,716,125 yd^3 (2,076,627 m^3) of cut and 2,767,463 yd^3 (2,115,878 m^3) of fill, resulting in a net of 51,337 yd^3 (39,250 m^3) of fill (DON 2013a). Alternative 4 would involve the largest volume of excavation to construct of any of the action alternatives except Alternative 3 (Alternative 3 would involve the greatest; Alternative 2 would require the least). Within the Alternative 4 footprint, there are major differences in elevation in the areas planned for construction of the MPMG and KD Rifle ranges. There would be substantial changes to surface elevation for construction of the MPMG and KD Rifle ranges (DON 2013b). Because of the major elevation changes, the substantial alteration of the surrounding landscape, and the amount of excavation, filling, stream re-routing and contouring that would occur, NAVMAG (L-Shaped) LFTRC alternative is expected to have a significant direct, long-term impact on topography. Potential mitigation is not considered feasible for this impact because smaller cut/fill volumes would not provide the necessary level surfaces for the referenced ranges. The significant impact to topography would occur with implementation of any LFTRC alternative except Alternative 2, which would involve the least amount of cut and fill (i.e., the impact would be similar for all alternatives except Alternative 2).

Construction of the HG Range would involve 8,894 yd^3 (6,800 m^3) of cut and 12,641 yd^3 (9,665 m^3) of fill, for a net of 3,747 yd^3 (2,865 m^3) of fill. Thus, the total net fill for Alternative 4 would be 55,084 yd^3 (42,115 m^3).

Alternative 4 would site the MPMG Range in the same steeply-sloped area as Alternative 3, and the remaining ranges in the less steep Alternative 2 footprint. The differences in elevation in the northern portion of the Alternative 4 area planned for construction of the MPMG Range are substantially greater than the natural elevation differences in the Alternative 2 footprint. To construct the MPMG Range at Alternative 2, a 30-feet (10-m) high slope would be leveled with about 942,500 yd^3 and (725,000 m^3) of cut and 910,000 yd^3 (700,000 m^3) of fill. To construct the same range at Alternative 4, a 75-to-100 feet (22 to 30 m) high slope would be leveled with 2.47 million yd^3 (1.9 million m^3) of fill. Due to the steeper

topography in the Alternative 4 footprint, more than twice as much excavation and fill would be needed overall to level the ranges for Alternative 4 as for Alternative 2. There is a potential for increased erosion, compaction, and soil loss from physical disturbance caused by construction activity and changes to existing topography. However, project design and construction would incorporate engineering controls as BMPs to minimize erosion within the project construction footprint, as required by Title 22 of GAR, Chapter 10 Guam Soil Erosion and Sediment Control Regulations. Examples of such engineering controls are described in Section 5.2.1.2 of this SEIS.

In addition, construction activities associated with Alternative 4 would comply with the Construction General Permit. Potential construction-specific stormwater BMPs would be implemented in compliance with the Construction General Permit. Construction-specific stormwater BMPs would provide erosion and sediment control during the construction period, generally by employing off-site measures that reduce the flow of stormwater and minimize the transport of soils and sediment off-site. Fill material would be generated off-site, whenever possible. In addition, roadway-specific BMPs, as identified in the most recent *CNMI and Guam Stormwater Management Manual,* would be included in the planning, design, and construction of all roadways and facilities. Through compliance with 22 GAR Chapter 10 and the Construction General Permit and implementation of roadway stormwater BMPs, and because the rate of erosion and soil loss would not be substantially increased, direct, short-term impacts to soils from erosion during construction of Alternative 4 would be less than significant. No indirect, short-term impacts associated with soil erosion are expected.

Construction of Alternative 4 would disturb agriculturally productive soils that are identified by the USDA as prime farmlands. As described in Section 5.2.6, Land and Submerged Land Use of this SEIS, no existing agricultural use is identified for the area of disturbance. Therefore, disturbance of these soils for construction of Alternative 4 would be an adverse, but less than significant direct, long-term impact to agricultural soils.

There are three topographic features that may contain sinkholes within, or on the perimeter of, the Alternative 4 footprint (see Figure 5.4.1.1). For any sinkholes discovered before or during construction, BMPs would include compliance with 22 GAR Chapter 10 § 10106F. In order to ensure compliance with 22 GAR Chapter 10 § 10106F, BMPs would be modified or an environmental and hydrogeologic assessment must be performed to ensure adverse effects will not result, including but not limited to the displacement of groundwater, interference with well production, significant changes to groundwater recharge, flooding, or the threat or introduction of any pollutant to groundwater. After a preferred alternative is selected and the ROD is signed for the proposed project, final design work would begin for the preferred alternative site. A geotechnical study, including subsurface borings, would be conducted to determine whether the depressions on the site contain sinkholes, and whether there are additional sinkholes not evident from the surface. Hydrogeological studies would be conducted to confirm groundwater flow at the site as well. The geotechnical and hydrogeological studies would be coordinated with the GEPA to design and implement an appropriate analysis. These studies would be part of the final design process and would take place before any construction begins. With implementation of these BMPs, and since no sinkholes would be filled that would adversely affect site drainage, no adverse impacts to sinkholes would occur. Therefore, construction of Alternative 4 would have less than significant direct, short-term impacts to sinkholes.

Hazards associated with earthquakes, fault rupture and slope instability would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 (USACE 2013). The Alternative 4 site is located inland and above the elevation prone to tsunamis, and so would not be susceptible to

inundation. The consolidated limestone and volcanic bedrock underlying the site is not vulnerable to liquefaction. In addition, there would not be a change to soil and/or bedrock conditions that would increase vulnerability to a geologic hazard. As stated in the previous paragraph, 22 GAR Chapter 10 § 10106F requires that for sinkholes within the project development footprint that would be modified or used, an environmental and hydrogeologic assessment must be performed to ensure adverse effects will not result. Compliance with these regulations would minimize potential geologic hazards associated with sinkholes. Therefore, construction of Alternative 4 would have less than significant direct and indirect short-term impacts with respect to geologic hazards.

Operation

Operational impacts associated with the HG Range at Andersen South would be similar to those described under Alternative 1 in Section 5.1.1.2 of this SEIS.

Alternative 4 operations would not alter topography post construction, so no direct or indirect impact to topography would occur.

The firing range activities and conditions and conditions that may directly cause or increase naturally occurring soil erosion during the operational phase would be the same as for Alternative 3 and are described in Section 5.2.1.2 of this SEIS. Similar to Alternative 3, under Alternative 4 the significant long-term changes to topography during construction of the MPMG and KD Rifle ranges could alter natural surface flow patterns that could increase soil erosion. Munitions storage in the relocated magazines would not involve any surface disturbance other than minimal excavation for utility maintenance.

The area of impervious surfaces that would be constructed for the ranges and associated infrastructure (range buildings, roads, and parking areas) would be approximately 33.3 acres (13.5 ha) total (Appendix F) including about 32.4 acres (13.1 ha) for Alternative 4 and about 0.9 acre (0.4 ha) for the HG Range. There would be a minor increase in runoff from the new impervious surface area as compared with existing conditions. Stormwater infrastructure improvements included as part of the proposed action would incorporate LID measures and BMPs to minimize soil erosion from this increased runoff. Where possible, stormwater flow paths would continue to mimic pre-development flows through area topography. During the operations phase, stormwater BMPs that would be implemented to minimize and control runoff would also minimize soil erosion.

The range complex would be managed in accordance with current Marine Corps range management policies and procedures, which are designed to ensure the safe, efficient, effective, and environmentally sustainable use of the range area. A thorough explanation of Marine Corps range management is detailed in the 2010 Final EIS (Volume 2, Chapter 2: Description of Proposed Action and Alternatives, Section 2.3.1.4: Firing General Military Skills, pages 2-55 to 2-59). Marine Corps range management policies and procedures include procedures for removing expended rounds from live-fire ranges with impact berms every 5 years, managing stormwater, controlling erosion, maintaining vegetation on berms and drainage ways and turf on the range, and restricting vehicular activities to designated/previously identified areas. Range roads would be maintained to minimize erosion.

There would be minor ground disturbance associated with utility maintenance. Construction stormwater BMPs would be implemented during maintenance activities to minimize and control runoff on-site and minimize potential effects of erosion.

USDA-identified prime farmland soils in the proposed NAVMAG (L-Shaped) LFTRC area would be disturbed. However, there are no existing agricultural uses of the soils that would be disturbed. Therefore, Alternative 4 operations would have a less than significant direct, long-term impact to agricultural soils.

A potential indirect impact of firing range operations includes the possibility of live ammunition causing wildland fires. As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's *Wildland Fire Management Plan* (USFS 2008). It would include protocols for monitoring fire conditions and adjusting training as needed. Units undergoing training at the ranges would be briefed by range control on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). The existing *Wildland Fire Management Plan* (USFS 2008) that covers NAVMAG would be extended to cover bordering non-federal lands that could spread fire onto the ranges and would continue to be implemented under Alternative 4. With these measures, potential wildfires caused by the live ammunition would be unlikely. Effects to soils from erosion associated with wildfires associated with operation of Alternative 4 would be minimal and direct and indirect impacts would be less than significant.

With implementation of Marine Corps range management policies and procedures, fire suppression and potential mitigation measures, and stormwater BMPs (for ranges and ground-disturbing maintenance) less than significant direct and indirect long-term impacts to soils from erosion would occur due to Alternative 4 range operations.

The BMPs for sinkholes would be implemented in the event that maintenance activities should involve sinkholes or their immediate perimeter, so no adverse impacts to sinkholes would occur. Therefore, Alternative 4 operations would have less than significant direct, long-term impacts to sinkholes.

Hazards associated with earthquakes, fault rupture and slope instability would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 2013 (USACE 2013) during project design and construction so direct and indirect long-term impacts with respect to seismic hazards would be less than significant. The bedrock underlying the site is not vulnerable to liquefaction. The Alternative 4 location is inland and higher than the elevation prone to tsunamis, so it would not be susceptible to inundation. In addition, there would not be a change to soil and/or bedrock conditions that would increase vulnerability to a geologic hazard. Implementation of sinkhole BMPs would minimize potential geologic hazards associated with sinkholes. Therefore, Alternative 4 operations would have less than significant direct and indirect long-term impacts associated with geologic hazards.

5.4.2 Water Resources

5.4.2.1 Affected Environment

The affected environment for the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.1 of this SEIS. The rest of the Alternative 4 project area (Figure 5.4.2-1) overlaps the Alternative 2 and 3 project areas and the Alternative 4 affected environment for water resources is the same as described under Alternative 2 and 3 in Sections 5.2.2.1 and 5.3.2.1, respectively, of this SEIS. A summary of site conditions for Alternative 4 is provided in Appendix F.

Recent off-site wetland confirmation surveys were conducted at NAVMAG in May and November 2012 for this SEIS. The off-site confirmation was a non-jurisdictional wetland delineation (delineation being the establishment of wetland boundaries). A jurisdictional delineation establishes the boundaries of wetlands that are subject to requirements in the CWA and its implementing regulations and requires the approval of the USACE.

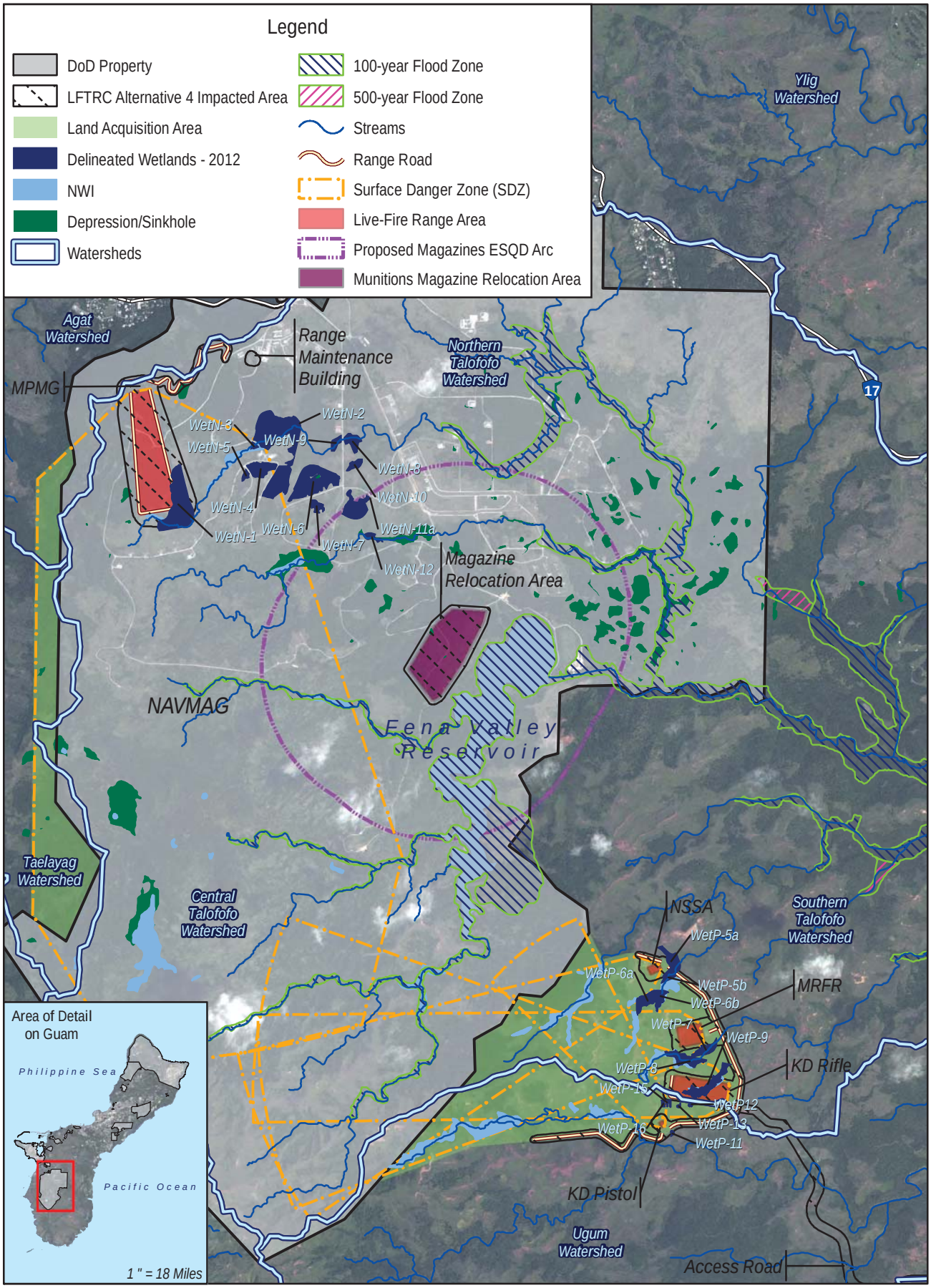


Figure 5.4.2-1
Surface Waters and Wetlands in the Vicinity of NAVMAG (L-Shaped) LFTRC Alternative 4

Sources: WERI 2001; USGS 2003; FEMA 2007; USFWS 2010; NAVFAC Pacific 2013

The wetlands identified during the 2012 survey are palustrine emergent wetlands with persistent vegetation that are either seasonally flooded/saturated (PEM1E) or semi-permanently flooded (PEM1F). The 2012 field survey delineated a total of 25.2 acres (10.2 ha) of wetlands in the project area as shown in Figure 5.4.2-1 and Table 5.4.2-1 (NAVFAC Pacific 2013b). This total includes 3.3 acres (1.3 ha) of forested wetlands as mapped by USFS (2006). All of these wetlands are all considered potentially jurisdictional pending a Jurisdictional Determination by the USACE.

For portions of the project area located outside the 2012 field survey, NWI data was used (NWI maps indicate the potential for wetland areas, but are not official determinations). The NWI maps indicate 7.0 acres (2.9 ha) of NWI wetland areas as shown in Table 5.2.2-1 and Figure 5.2.2-2 (USFWS 2010). The NWI wetlands are identified as palustrine emergent wetlands with persistent vegetation that are either seasonally flooded (PEM1C) or semi-permanently flooded (PEM1F); palustrine forested that are seasonally flooded (PFO3C); and palustrine scrub/shrub vegetation that are seasonally flooded (PSS1C).

The project area outside the 2012 survey area would require a wetland delineation survey and review by the USACE to verify the location and size of any wetlands and whether they are jurisdictional.

Table 5.4.2-1. Summary of Wetland Acreages for Alternative 4

Wetland Type	*Wetland Area(acres [ha])*
Delineated Wetlands within the 2012 Survey Area	
PEM1E*	19.6 (7.9)
PEM1F*	5.6 (2.3)
NWI Wetlands Outside the 2012 Survey Area	
PEM1C*	0.4 (0.2)
PEM1F*	5.7 (2.3)
PFO3C*	0.2 (0.1)
PSS1C*	0.7 (0.3)
Total	**35.2 (13.9)**

Note: *Wetland types are based on the classification of Cowardin *et al.* (1979).
Sources: USFWS 2010; NAVFAC Pacific 2013b.

5.4.2.2 Environmental Consequences

Construction

General construction impacts to water resources would be similar to those described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.4: South, page 4-112) and under Alternative A in Section 4.1.2.2 of this SEIS. Alternative 4 would occur in an area that contains waters of the U.S. and would be required to comply with the Construction General Permit as described under Alternative A in Section 4.1.2.2 of this SEIS. Construction impacts associated with the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.2 of this SEIS.

Under Alternative 4, proposed LFTRC construction activities at NAVMAG and non-DoD lands would result in the potential for a short-term increase in stormwater runoff, erosion, and sedimentation. However, through compliance with the Construction General Permit and Program SWPPP and implementation of a site-specific SWPPP and associated erosion control, runoff reduction, and sediment removal BMPs (see Table 4.1.2-2), these effects would be minimized. Specifically, the site-specific SWPPP would identify appropriate BMPs for the site that would serve to contain runoff and sediment off-site by reducing the flowrate of runoff and thereby minimize transport of suspended sediment through settling and promote infiltration of runoff.

Surface Water

Surface waters that are potentially affected by the various project footprints are shown in Figure 5.4.2-1. The MPMG Range would drain to the Talisay River. The Non-standard Small Arms Range would drain to an unnamed tributary of the Sagge River. The MRF Range and the majority of the KD Rifle Range would drain to Sarasa River. The remaining portion of the KD Rifle Range and the pistol range would drain into the Bubulaon River at the northern extent of the Ugum Watershed (NAVFAC Pacific 2013a). The access road would cross the Bubulao and Ugum rivers. The range roads would cross the Sarasa, Malaja, and Bubulao rivers. The Magazine Relocation Area would be located in the Central Talofofo Watershed and has the potential to contribute to sedimentation of Fena Valley Reservoir. Construction under Alternative 4 would include clearing of vegetation, grading (cut and fill), permanent or temporary accumulation of soils, stream rerouting, and filling in of natural areas. Potential effects from stormwater runoff would be minimized by adhering to the provisions of the Construction General Permit and implementing of a Program SWPPP and site-specific SWPPP and associated BMPs that would address site- and activity-specific surface water protection requirements. Implementation of construction BMPs under Alternative 4 would also minimize sedimentation impacts to Fena Valley Reservoir and support the compliance with load allocations under the sediment TMDL for Ugum Watershed.

Construction activities that involve substantial earth moving and those that are within or near stream channels would be would be scheduled for the dry season (January to May), to the extent possible (NAVFAC Pacific 2013a). Measures to minimize erosion within the project construction footprint, stabilize banks, and protect stream channels would be the same as described under Alternative 2 in Section 5.2.2.2 of this SEIS. Given the short-term nature of potential surface water impacts, compliance with Construction General Permit requirements, and implementation of BMPs, construction activities associated with Alternative 4 would result in less than significant short-term impacts to surface water.

Groundwater

Construction activities under Alternative 4 would include stormwater runoff protection measures that would also serve to protect groundwater quality. By adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific water resource protection requirements, there would be a reduction in stormwater pollutant loading potential and thus a reduction in pollution loading potential to the underlying groundwater basins. Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs), construction activities associated with Alternative 4 would result in less than significant short-term impacts to groundwater.

Nearshore Waters

Construction activities associated with Alternative 4 would occur more than 1 mile (1.6 km) from the coastline and would not result in direct impacts to the nearshore waters from stormwater runoff. Compliance with the Construction General Permit and implementation of BMPs under Alternative 3 would protect water quality in the Talofofo River and support the compliance with load allocations under the sediment TMDL for Ugum Watershed, ensuring that stormwater runoff from the project area would not cause indirect impacts to nearshore waters in Talofofo Bay (see Figure 5.2.2-1). Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs), construction activities associated with Alternative 4 would result in no impacts to nearshore waters.

Wetlands

Implementation of Alternative 4 could result in long-term, direct impacts to up to 25.2 acres (10.2 ha) of potentially jurisdictional wetland areas (see Figure 5.4.2-1). These direct impacts would be at the MPMG and KD Rifle ranges and range roads. There are an additional 7.0 acres (2.9 ha) of NWI wetlands in portions of the project area that have not been surveyed (see Section 5.2.2.1 in this SEIS).

Direct impacts (fill) to jurisdictional wetlands would be a significant impact. If these wetland areas are determined to be jurisdictional by the USACE, and therefore subject to Section 404 requirements, the Marine Corps would first attempt to avoid impacts. If avoidance is not possible, then the Marine Corps would obtain a Section 404 permit from the USACE to fill the wetlands and comply with minimization and potential mitigation measures outlined in the permit (see Table 5.7-1). Unavoidable direct impacts to jurisdictional wetlands would be mitigated by creating new wetlands, restoring or enhancing existing wetlands, or preserving existing wetland areas on Guam to, at a minimum, replace the area filled at a mitigation ratio greater than 1:1.

As described under Alternative 2, a mitigation plan would be prepared under Alternative 3 as part of the Section 404 permitting process. If Alternative 4 is chosen and wetlands cannot be avoided, the Marine Corps understands that a LEDPA determination must be made as part of the permitting process and that if the USACE determines this alternative is not the LEDPA, a Section 404 permit under the CWA cannot be granted and Alternative 4 would not be implemented. Through implementation of the potential mitigation measures and procedures identified above, significant impacts to wetlands would be reduced to a level below significant. By comparison, Alternatives 1 and 5 would have no impacts to wetlands and Alternatives 2 and 3 would have significant long-term, direct impacts to up to 17.7 acres (7.2 ha) and 36.9 acres (15.0 ha) of potentially jurisdictional wetland areas, respectively, which would be mitigated to a level below significant.

There would also be potentially jurisdictional wetlands adjacent to and downstream of construction areas that would be subject to potential indirect impacts during construction. These short-term, indirect impacts would be minimized by adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific stormwater runoff protection requirements.

Operation

Alternative 4 would incorporate the concept of LID in the final planning, design, and permitting of the stormwater runoff and drainage design as described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-85 to 4-87) and under Alternative A in Section 4.1.2.2 of this SEIS. Operation impacts associated with the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.2 of this SEIS.

Under Alternative 4, there would be a minor increase in the area of impervious surface as a result of ranges and associated support facilities, which would result in an associated increase in stormwater discharge intensities and volume. However, the proposed action would incorporate LID measures and BMPs to ensure stormwater retention would be consistent with local and federal requirements and thus minimize potential impacts to surface water quality. Alternative 4 would also be implemented in accordance with all applicable orders, laws, and regulations including the preparation and implementation of a SWPPP, SWMP, and SPCC plan that would control runoff and minimize potential leaks and spills. Where possible, stormwater flow paths would continue to mimic pre-development flows through area topography.

Alternative 4 would include implementation of the REVA program and range management preventative measures (i.e., vegetation, pH adjustment, LID). As listed in Section 2.8 of this SEIS, the BMPs would reduce the potential for contaminants to migrate off-site. In addition, the DoD would investigate additional technologies that could assist with range design and management to minimize potential impacts. Available baseline data regarding range site conditions would be reviewed and verified prior to range construction and regular monitoring would occur during operations to verify the effectiveness of BMPs. For each range, water quality treatment strategies would be selected to achieve reductions of non-point source pollutants to meet the same water quality requirements as identified under Alternative A in Section 4.1.2.2 of this SEIS.

Surface Water

The *Watershed Reconnaissance Study* (NAVFAC Pacific 2013a) identified potential direct and indirect impacts to surface waters during the operational phase of Alternative 4, as described under Alternative 2 in Section 5.2.2.2 of this SEIS (see Appendix F). Potential effects from stormwater runoff would be minimized through the implementation of an appropriate and comprehensive stormwater management plan utilizing a LID approach and BMPs under Alternative 4. Implementation of LID measures and BMPs under Alternative 4 would also support the compliance with load allocations under the sediment TMDL for Ugum Watershed.

Firing range operational-phase LID measures and BMPs would focus on reducing volume and velocity of stormwater runoff, minimizing soil erosion potential within the range boundaries, and controlling the spread of lead bullets and bullet fragments. Implementation of the REVA program and BMPs for containing and limiting off-site migration of lead contaminants would be the same as described under Alternative 2 in Section 5.2.2.2 of this SEIS and are listed in Section 2.8 of this SEIS.

Appropriate fire suppression and potential mitigation measures would also be incorporated into the design (fire resistant structures) and range operating procedures as described under Alternative 2 in Section 5.2.2.2 of this SEIS. The portion of the Alternative 4 project area on non-federal lands would have the same fire susceptibility compared Alternative 2, while the portion of the project area on NAVMAG would have a reduced fire susceptibility compared to Alternative 2. The existing Wildland Fire Management Plan (USFS 2008) that covers NAVMAG would be extended to cover the non-federal lands and would continue to be implemented under Alternative 4. Therefore, the risk of exposing soils to erosion due to arson or natural wildland fires would be relatively lower for Alternative 4 ranges located within NAVMAG.

Because none of the proposed Alternative 4 firing range footprints fall within the Central Talofofo Watershed, stormwater runoff from the proposed range footprint areas would not drain to the Fena Valley Reservoir (see Figure 5.4.2-1). The Magazine Relocation Area would be located in the Central Talofofo Watershed and has the potential to contribute to sedimentation of Fena Valley Reservoir. However, the magazine would include appropriate LID measures and BMPs to minimize erosion within the project construction footprint and transport of sediment to surface waters. The SDZ associated with Alternative 4 would partially overlay the Central Talofofo Watershed (see Figure 5.4.2-1), but potential impacts to the water quality of Fena Valley Reservoir from expended projectiles would be negligible as described under Alternative 2 in Section 5.2.2.2 of this SEIS.

No buildings/structures would be constructed in the 100-year or 500-year flood zone. It is anticipated that developing the proposed footprint areas would not impact water surface elevation levels in FEMA-regulated floodplains. However, this would be confirmed through detailed hydraulic and hydrologic

modeling during the final design phase. Any rise in the elevations would be covered by FEMA regulations and would need to be approved by the local floodplain administrator.

Alternative 4 operations would be conducted in accordance with all applicable orders, laws, and regulations including the preparation and implementation of a SWPPP, SWMP, and SPCC Plans that would control runoff and minimize potential leaks and spills. Given implementation of these stormwater runoff protective measures and range operation BMPs for containing and limiting the migration of lead contaminants, operations associated with Alternative 4 would result in less than significant long-term, direct or indirect impacts to surface water.

Groundwater

Under Alternative 4, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would also serve to protect groundwater quality and recharge. Specifically, implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that any stormwater runoff recharging to groundwater basins would be of acceptable quality. BMPs to minimize lead transport would minimize contamination of groundwater. Given stormwater runoff protection measures (e.g., implementation of the REVA program, LID, and SWPPP measures), operations associated with Alternative 4 would result in less than significant long-term, direct impacts to groundwater.

Nearshore Waters

Under Alternative 4, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would also prevent direct impacts to the nearshore waters from stormwater runoff. Implementation of LID measures and BMPs under Alternative 4 would protect water quality in the Talofofo River and support the compliance with load allocations under the sediment TMDL for Ugum Watershed, ensuring that stormwater runoff from the project area would not cause indirect impacts to nearshore waters in Talofofo Bay. Given stormwater runoff protection measures (i.e., implementation of LID, BMPs, and pollution prevention plans), operations associated with Alternative 4 would result in no impacts to nearshore waters.

Wetlands

Under Alternative 4, proposed operations have the potential to cause indirect effects to nearby down-gradient wetland areas (see Figure 5.4.2-1). However, the stormwater runoff protection measures identified above would also serve to protect water quality entering wetlands. Specifically, implementation of LID measures and the provisions of the SWPPP and associated erosion control activities would ensure that the stormwater runoff flowing into wetlands would be of acceptable quality. Given stormwater runoff protection measures (i.e., implementation of LID, BMPs, and pollution prevention plans), operations associated with Alternative 4 would result in less than significant long-term, indirect impacts to wetlands.

5.4.3 Air Quality

5.4.3.1 Affected Environment

The areas around Alternative 4 are not developed and no sensitive populations are present. Ambient air quality conditions in these areas can be considered typical for a rural area and include few activities involving operations of either major stationary or mobile sources.

5.4.3.2 Environmental Consequences

The construction activities associated with Alternative 4 would be similar to Alternative 1, with the exception of site location. Therefore, the predicted construction activity annual emissions would be the same as Alternative 1, as summarized in Table 5.1.3-2, and are well below the significance criterion of 250 tpy.

The hot-spot air quality impacts during both construction and operational phases would be similar to Alternative 1, as discussed in Section 5.1.3; resulting in less than significant short-and long-term direct hot-spot air quality impacts.

5.4.4 Noise

5.4.4.1 Affected Environment

The affected environment for this alternative would be the same as both Alternatives 2 and 3 because this alternative uses a split firing range configuration and entails the use of both the north and southeast portions of NAVMAG and the surrounding area.

5.4.4.2 Environmental Consequences

Construction

Similar to Alternative 3, there would be no impact due to construction noise under Alternative 4 because construction activities would be in a sparsely populated area of Guam. Construction areas would be approximately 0.25 mile (0.4 km) away from the nearest receptors, a distance that is far enough away from the source of construction noise such that there would be minimal noise effects on receptors.

Operation

Noise levels under Alternative 4 would be very similar to both Alternatives 2 and 3 combined. In the north, the MPMG Range uses the loudest ammunition with the .50 cal rounds and it dominates the noise levels under Alternative 3. However, in the southeast noise levels would not be as high as described under Alternative 2 because the MPMG Range would be in the north.

Under Alternative 4, the Zone 2 noise contours cover approximately 296 acres (119 ha) beyond the boundaries of NAVMAG and Zone 3 covers 33 acres (13 ha). The off-base acreage would extend towards the north and west of NAVMAG and beyond the south and east boundaries. Modeling results (Army 2013) for the NAVMAG (L-Shaped) LFTRC are shown on Figure 5.4.4-1. No houses lie within the noise contours, and therefore no people would be affected by Zone 2 or Zone 3 noise contours. The same approximately 70-80 homes discussed in the North/South Alternative would be within the Zone I noise contours in the area along Route 12 adjacent to Our Lady of Guadalupe Church and would experience noise levels between 55 and 60 dB ADNL. Another approximately 100 homes would be within the Zone I contours in Agat near the Pagachao Guam Housing and Urban Renewal Authority housing area with noise levels approximately 55 to 68 dB ADNL. Although noise levels would be greater than existing levels, this area would still be considered compatible for residential use. Noise levels may be less than predicted because the area is on the opposite side of the hill from the proposed firing line and the area is heavily wooded. Both of these factors attenuate sound levels. Table 5.4.4-1 lists Noise Zones 2 and 3 and the associated acreage affected within each zone.

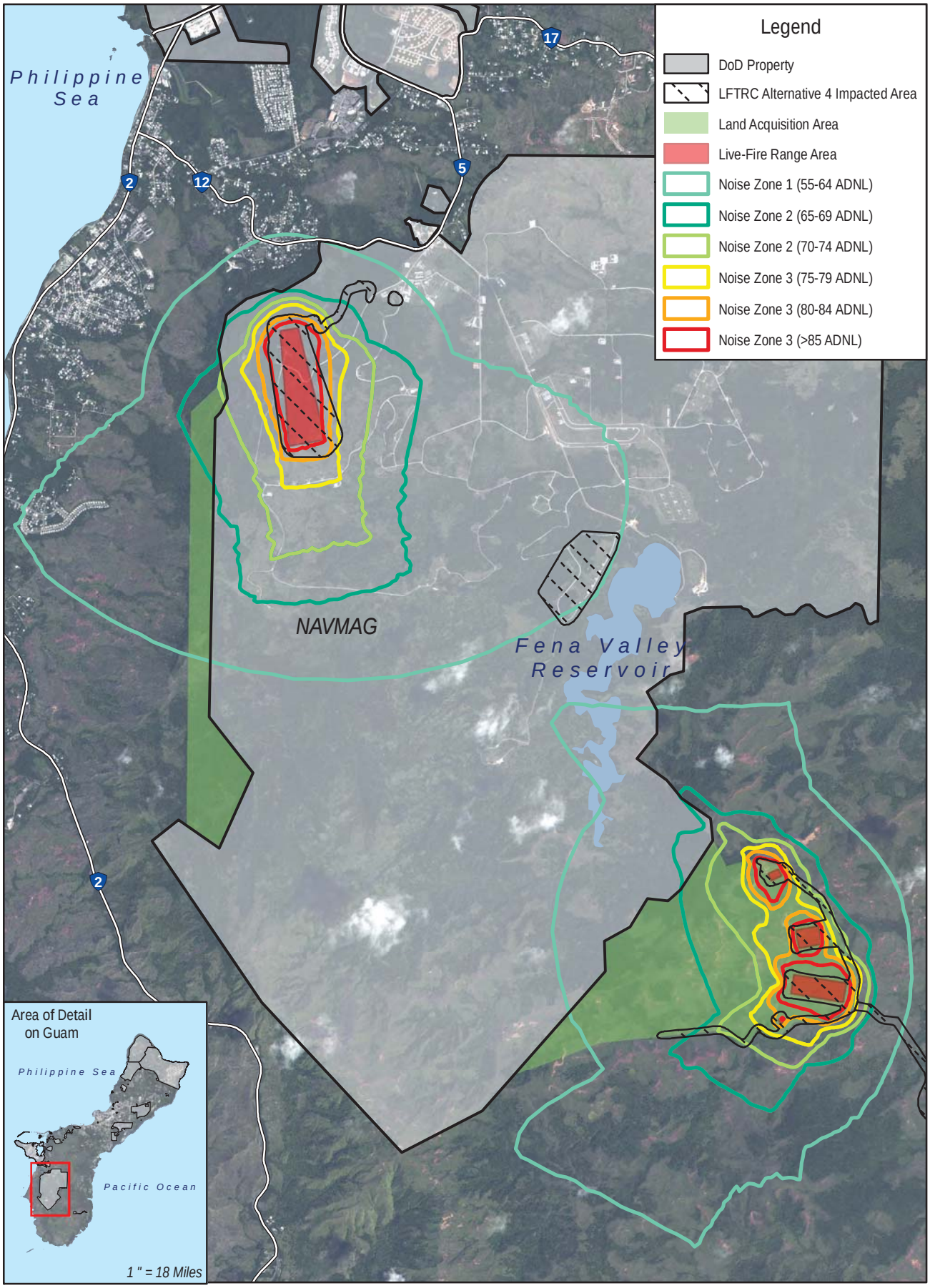


Figure 5.4.4-1
Small Arms ADNL Noise Zones for
NAVMAG (L-Shaped) LFTRC Alternative 4

Table 5.4.4-1. Noise Exposure within Noise Zones under LFTRC Alternative 4

Noise Zone (dB DNL)[1]	*Acreage (ha)*		*Population*	
	On-base	*Off-base*	*Houses*	*People*
Noise Zone 2				
65 - 69	630 (255)	221 (89)	0	0
70 - 74	382 (155)	75 (30)	0	0
Total Zone 2	**1,012 (410)**	**296 (119)**	**0**	**0**
Noise Zone 3				
75 - 79	162 (66)	26 (11)	0	0
80 - 84	110 (45)	6 (2)	0	0
85+	191 (77)	1 (0)	0	0
Total Zone 3	**463 (188)**	**33 (13)**	**0**	**0**
Grand Total	**1,475 (690)**	**329 (132)**	**0**	**0**

Note: [1]Zone 1 is not listed because all land uses are compatible within Zone 1.
Source: Army 2013, NAVFAC Pacific 2013.

Under Alternative 4, no people would be impacted by Zone 2 or 3 noise levels because there are no residences within these zones. There would be no direct impacts due to live-fire training noise under Alternative 4 because there would be no populated residential areas affected and none of the noise significance criteria stated in the Marine Corps Guidance memo for land use and noise exposure would be exceeded (Marine Corps 2005). There would be no direct or indirect impacts because no population would be affected, and none of the impact assessment criteria related to potential noise impacts would be exceeded. As described in Section 5.1.4.2, noise levels at the HG Range would remain within Andersen South and not impact any residences. In summary, there would be no residences/households affected by noise resulting from implementation of Alternative 2 and, consequently, no significant noise impacts would occur.

In comparison, only Alternative 1 would potentially result in significant noise impacts; however, those impacts could be mitigated to less than significant through the use of berms and natural foliage.

5.4.5 Airspace

5.4.5.1 Affected Environment

The existing airspace conditions for Alternative 4 would be the same as described for Alternative 1 (see Section 5.1.5.1 of this SEIS). Detailed information on military and civilian air traffic associated with AAFB and Guam International Airport, respectively, is provided in the 2010 Final EIS (Volume 2, Chapter 7: Airspace, Section 7.1: Affected Environment, pages 7-8 through 7-10).

5.4.5.2 Environmental Consequences

Construction

No changes to airspace would be required during construction of the LFTRC under Alternative 4, and construction activities would not be expected to conflict or interfere with the use or management of existing airspace in the vicinity. Therefore, construction of the LFTRC under Alternative 4 would have no impact on airspace.

Operation

Figure 5.4.5-1 depicts the proposed Restricted Area associated with Alternative 4. This SUA would be needed to contain the vertical hazard associated with the proposed live-fire training. Boundary coordinates for the proposed NAVMAG (L-Shaped) Option B of R-7202 Guam would begin at:

- lat.13°22'56"N., long.144°39'54"E
- to lat.13°22'58"N., long.144°40'57"E
- to lat.13°19'34"N., long.144°43'28"E
- to lat.13°18'58"N., long.144°41'9"E
- to lat.13°20'13"N., long.144°39'56"E
- to the point of beginning

Altitudes, times of use, and controlling and using agencies for this Restricted Area SUA would be the same as described in Section 5.1.5.2 for Route 15 LFTRC Alternative 1. The proposed CFA associated with the HG Range at Andersen South would be the same as described in Section 5.1.5.2 and depicted in Figure 5.1.5-4.

Section 3.5.3.1 identifies the potential impacts to airspace from implementation of the LFTRC alternatives. Given its location, the proposed NAVMAG (L-Shaped) LFTRC Alternative would directly impact arrivals into and departures out of Guam International Airport. The FAA stated in the preliminary Airspace Feasibility Assessment (FAA 2013) that Alternative 4 is not feasible. However, the FAA stated that "an assignment of 'not feasible' to a specific alternative is not a statement of infeasibility, but merely an assessment of the airspace in regard to the level of assumed impact" (FAA 2013).

Operational activities under Alternative 4 have the potential for significant direct impacts to aviation due to the following:

- Guam International Airport Airspace and instrument approach procedures.
- Standard Instrument Departures and Standard Terminal Arrivals.
- IFR/VFR traffic flows.
- Terminal operations.

However, if this alternative is selected, long-term impacts and potential mitigation would be further studied through the DON/FAA/Air Force consultation process. The general types of potential mitigation measures that could be employed may include adjusting airspace per FAA coordination and/or adjusting LFTRC operation procedures if feasible. However, no specific potential mitigation measures are proposed at this time.

As detailed in Table 5.7-1, operational impacts under Alternative 4 would be the same as under Alternatives 1, 2, and 3. Operational impacts under Alternative 4 would be greater than impacts under Alternative 5.

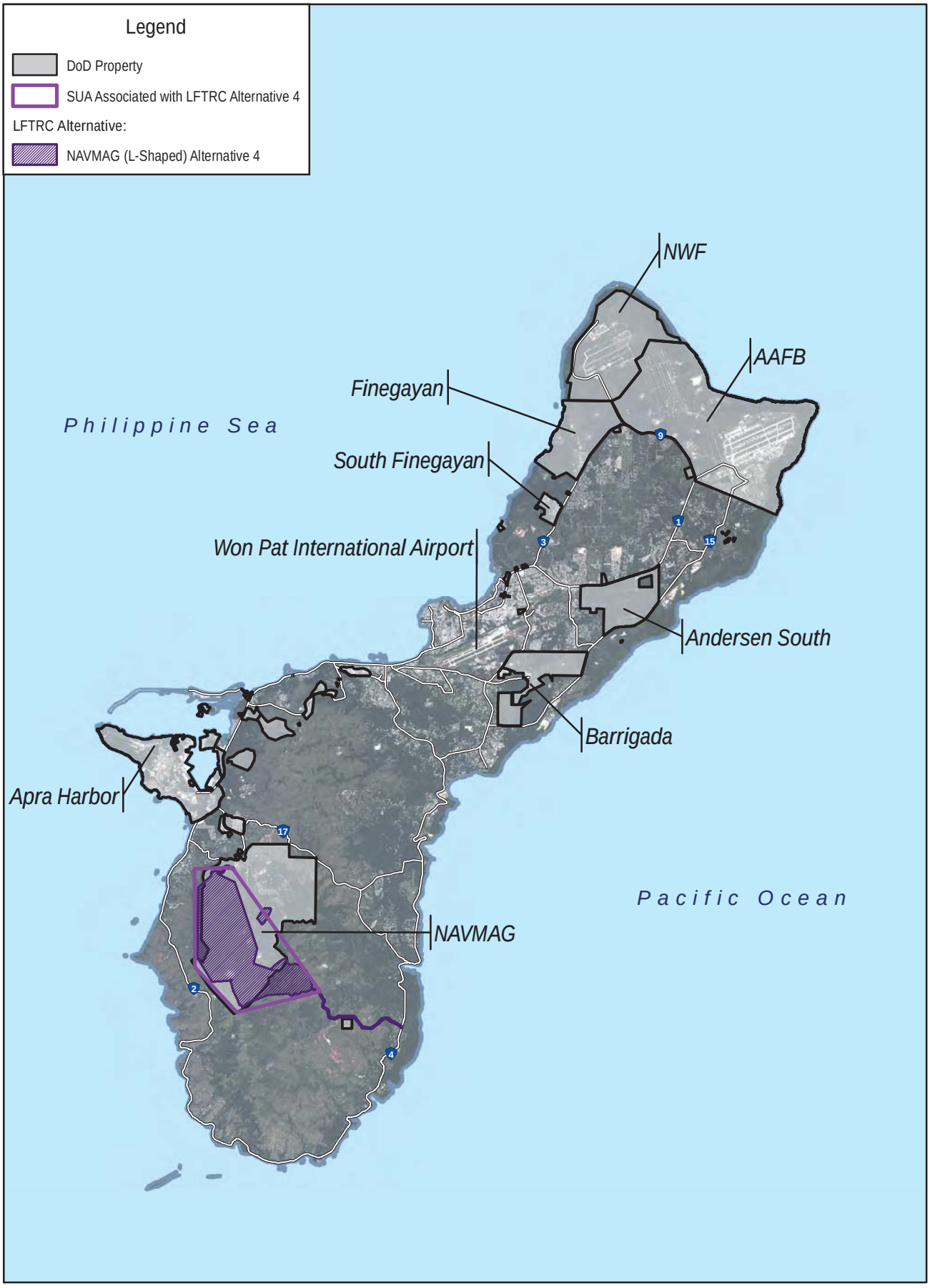


Figure 5.4.5-1
Proposed SUA Associated with LFTRC Alternative 4

5.4.6 Land and Submerged Land Use

5.4.6.1 Affected Environment

All LFTRC alternatives include a HG Range at Andersen South, the affected environment and impacts of which are described in Section 5.1.6 of this SEIS.

The proposed Alternative 4 requires acquisition of areas adjacent to the NAVMAG on the eastern and southwestern boundaries. In addition to the land required for the expanded NAVMAG installation boundary, land would be acquired for the access road connection to Route 4 (see Figure 5.2.6-1). The acreages to be acquired are described in Section 2.5.4.7, Summary of LFTRC Alternatives, Table 2.5-3. Most of the land proposed for acquisition is privately owned (see Figure 5.2.6-1). Additional detail on the number of lots affected and land ownership is provided in Section 5.2.15, Socioeconomics and General Services. No submerged land is impacted by implementation of Alternative 4 (Figure 5.4.6-1).

The primary existing land uses within NAVMAG are as described in Section 5.2.6. Alternative 4 would require relocation of existing NAVMAG munitions storage facilities within NAVMAG (see Figure 2.5-5).

All of the land proposed for acquisition is undeveloped and in its natural state (Appendix D SIAS; Figure 5.3-21, Table 5.3-4). There are no land use plans for the community surrounding the NAVMAG area of Guam. The GBSP land classification for the proposed acquisition area is Agriculture. However, as described in the Terrestrial Biological Resources Section 5.4.8, the acquisition area is within the Guam Bolanos Conservation Area, which is under Guam Department of Agriculture jurisdiction. Approximately 4.5% of Guam's USDA-designated prime and less than 1% of USDA-designated important farmlands were identified in the eastern acquisition area (Figure 5.4.6-1). No current agricultural use was identified in the aerial photographs.

Adjacent land uses to the NAVMAG (L-Shaped) LFTRC area include other NAVMAG land uses and non-federal lands that are classified by GBSP as Agriculture (Figure 5.4.6-1). There are residential areas (sensitive receptors) adjacent and east of the acquisition area and north, but not adjacent to the proposed MPMG Range.

Mount Lamlam and Mount Jumullong Manglo were identified west of the SDZs, but not adjacent (Figure 5.4.6-1).

5.4.6.2 Environmental Consequences

Land use impacts are addressed in this section. Land ownership impacts are addressed in Section 5.4.15, Socioeconomics and General Services.

Construction

As previously discussed in Chapter 3, Section 3.6.3.1, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource under any of the alternatives.

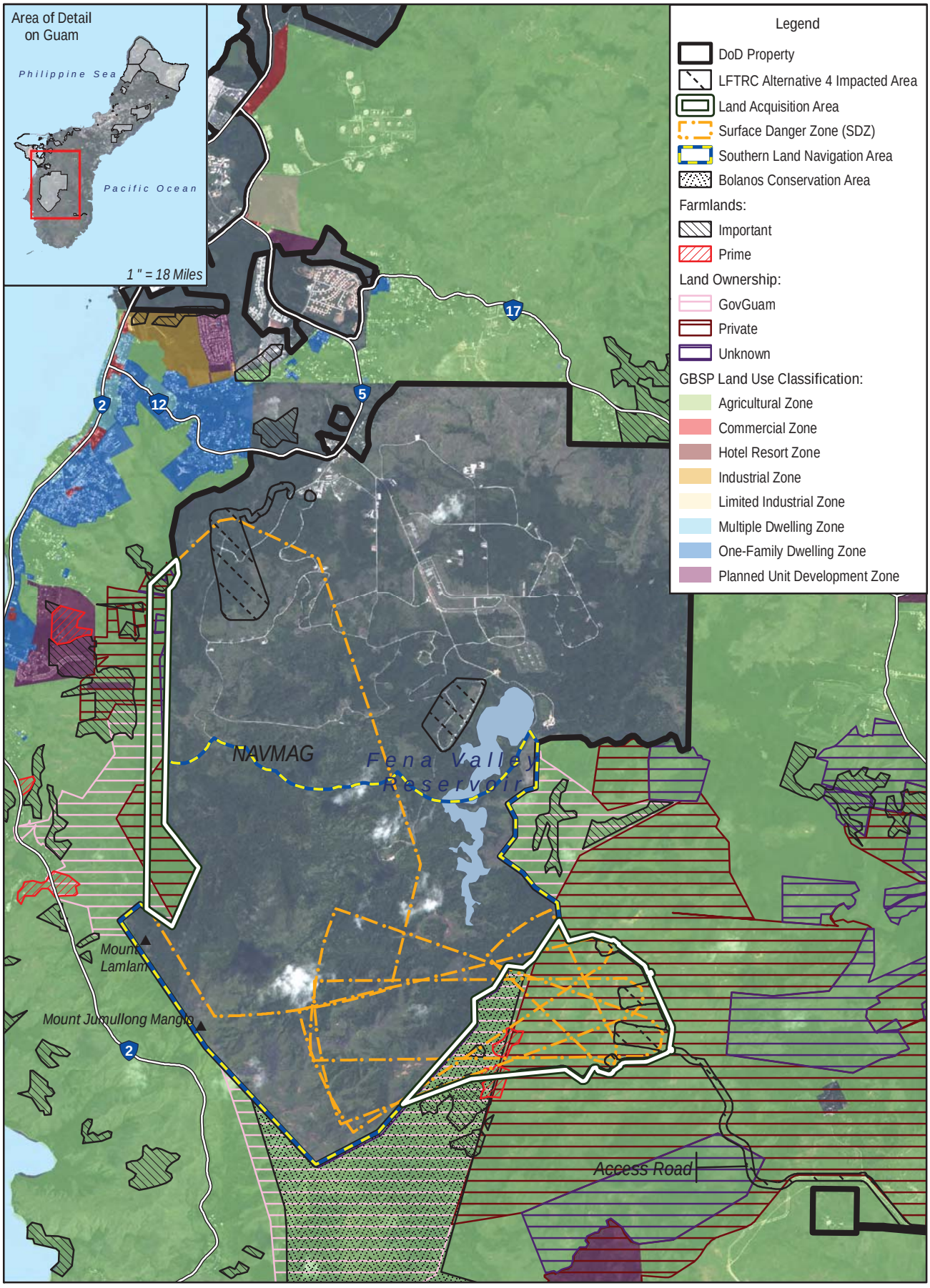


Figure 5.4.6-1
Land Use in the Vicinity of
NAVMAG (L-Shaped) LFTRC Alternative 4

Operation

Potential impacts on Fena Valley Reservoir and water supply are addressed in the Water Resources Section 5.2.2. LFTRC land use would be compatible with the existing military NAVMAG land use, except the use of the southern land navigation area would be discontinued and magazines would be relocated (see Figure 2.5-5). Any direct or indirect land use incompatibility issues related to the military mission within NAVMAG would be resolved through application of installation master planning guidelines outlined in UFC 2-100-01. Therefore, long-term land use impacts to NAVMAG would be less than significant.

The proposed NAVMAG (L-Shaped) LFTRC Alternative 4 would restrict GovGuam and public access to the portion of the Bolanos Conservation Area that would be within the land acquisition area. The impact of the long-term reduced access on conservation goals and objectives is primarily a terrestrial biological resources (Section 5.4.8) impact. As described in Section 3.6.3, Approach to Analysis, new access restrictions placed on non-DoD populations would be a potentially long-term direct significant impact when access to a specific community-valued land use would be affected. In addition, the reduction or loss of a valued land use would be a potentially significant long-term adverse impact. There would be potentially significant impacts associated with (1) new access restrictions and (2) the reduction in the Bolanos Conservation Area land use. The following may be a potential mitigation measure to reduce these impacts to a less than significant level:

- DoD would work with GovGuam to develop a plan to balance the loss of conservation land use and access with the operational needs and public safety concerns.

Indirect less than significant impacts to existing land use or GBSP classification of Agricultural land use were identified. The acquired area would largely remain as open space. USDA-designated prime and important farmlands were identified within the eastern acquisition area but the area is not currently used for agriculture. The loss of prime and important farmland is a long-term adverse impact, but is considered less than significant because it is not currently farmed and there are other prime and important farmlands available for agricultural use.

The proposed NAVMAG (L-Shaped) LFTRC would be compatible with surrounding vacant and residential land uses. The Zone 3 noise contour would extend slightly off-base near the ranges proposed in the east, as described in Section 5.4.4., Noise, and shown on Figure 5.4.4-1. The Zone 3 contour generated by the range in the north would not extend off-base. Zone 2 noise contours would extend beyond the proposed installation boundary of both the eastern and western acquisition areas (see Figure 5.4.4-1). However, no existing or planned residential land uses (or other sensitive receptors like schools or medical facilities) were identified within the Zone 2 or 3 contours. The acquisition area is classified by GBSP as Agriculture, which is a compatible use within the Zone 2 and 3 noise contours. Long-term direct impacts to future land use, due to LFTRC noise, would be less than significant

New utility infrastructure and the access road easements are compatible with the current vacant land use and GBSP Agriculture classification. The new access road would facilitate public access to remote areas. This new access could be considered a potential long-term beneficial and a less than significant impact on adjacent and nearby land use. The landowners may appreciate improved access to their property, but they may also be concerned that a new roadway would facilitate public access.

As addressed in the Cultural Resources and Recreational Resources sections (5.4.10.2 and 5.4.7.2, respectively), Mount Lamlam and Mount Jumullong Manglo public access would not be subject to additional restrictions.

Alternatives 2 and 4 would have a similar level of impact to land use resources due to the loss of public access and valued land uses from the Bolanos Conservation Area. However, the significant impacts are potentially mitigable and would have less of an impact than Alternative 1, which has no mitigation proposed. Both Alternatives (2 and 4) would have a greater impact to land use than Alternative 3, which would have a less than significant impact.

5.4.7 Recreational Resources

5.4.7.1 Affected Environment

Recreational resources within and adjacent to Alternative 4 are the same as those discussed in Section 5.2.7 for Alternative 2.

5.4.7.2 Environmental Consequences

Construction

Construction and/or improvement of access roads on non-federal property would be required to reach the ranges proposed for Alternative 4. The construction impacts would be short-term in nature and would mostly be limited to construction and earth-moving equipment on public roadways slowing access to recreational resources. Although staged construction equipment would not obstruct access to, or the use, of recreational resources, inconveniences to resource seekers (e.g., potential detours, longer waits, and other similar nuisances) would result. However, construction of Alternative 4 would not substantially reduce recreational opportunities, cause substantial conflicts between recreational users, or cause substantial deterioration of recreational resources. Therefore, short-term less than significant impacts to recreational resources would be anticipated.

Operation

The recreational resources and access directly affected by the SDZs include lookout points (Mount Alifan Unit and the Japanese Lookout) and springs (Almagosa and Dobo Springs) located inside of the NAVMAG property (see 2010 Final EIS Volume 2, Chapter 9: Recreational Resources, Section 9.1.5.1: Affected Environment, pages 9-14 to 9-15). In addition to access restrictions, there are potential indirect impacts from firing range noise, which could lessen visitor enjoyment of publicly accessible recreational resources in the area of the LFTRC. However, direct and indirect long-term impacts would be less than significant for the following reasons:

- The 2010 Final EIS states that the impacts are less than significant at the NAVMAG site. Even though the current East/West and L-Shaped NAVMAG LFTRC alternatives extend eastward from NAVMAG and would require land acquisition, there are no identified recreational resources in those areas that would be directly or indirectly affected by land acquisition.
- The construction of the access road for the East/West and L-Shaped NAVMAG LFTRC alternatives would make access to the area easier for the public during those times the ranges are not in operation.

Known recreational resources in the area (primarily Talofofo Falls) would not be impacted by noise during training.

5.4.8 Terrestrial Biological Resources

5.4.8.1 Affected Environment

The proposed LFTRC Alternative 4 would include portions of the lands associated with Alternative 3 (see Section 5.3.8), the non-federal lands associated with the Alternative 2 (see Section 5.2.8), and some additional non-federal lands. These non-federal lands have similar vegetation and habitat types as the areas associated with Alternative 2. Refer to Sections 5.2.8.1 (Alternative 2) and 5.3.8.1 (Alternative 3) for general descriptions of the affected environment in the action area for the proposed L-Shaped ranges. A summary of specific new areas or where differences exist is provided below. For the purposes of the following discussion, the single northernmost range (the proposed MPMG Range) in the northwest portion of NAVMAG will be referred to as the northern portion of the Alternative 4 action area. The remaining proposed ranges associated with Alternative 4 that are located to the southeast of the NAVMAG on non-federal lands will be referred to as the southern portion of the Alternative 4 action area.

Vegetation Communities

Figure 5.4.8-1 depicts the vegetation communities associated with Alternative 4. The vegetation communities were mapped based on the sources described in Sections 5.2.8.1 and 5.3.8.1. The large MPMG Range and the magazine relocation area are within the NAVMAG portion of the L-shaped alternative. The proposed MPMG Range area (which is the same as Alternative 3) contains large areas of primary limestone forest as well as secondary limestone forest (Figure 5.4.8.1). Ravine forest dominates the magazine relocation area.

The remaining proposed ranges are within the southern portion of Alternative 4, which is similar to Alternative 2 in vegetative composition, and is primarily savanna vegetation interspersed with wetland vegetation associated with streams and drainages. Areas of herbaceous wetlands and barren areas (badlands) are also present. The area within the NAVMAG is associated with the SDZs of the proposed ranges and traverses savanna and patches of ravine forest (see Figure 5.4.8-1).

Terrestrial Conservation Areas

The SDZ of the proposed ranges overlies established Overlay Refuge lands within the NAVMAG and the northern portion of the GovGuam Bolanos Conservation Area (see Figure 5.2.8-2). Refer to Section 5.2.8.1 for further details on the Overlay Refuge and Bolanos Conservation Area.

Wildlife - Native Species

The native wildlife discussion in Sections 5.2.8.1 (Alternative 2) and 5.3.8.1 (Alternative 3) are also applicable for this alternative.

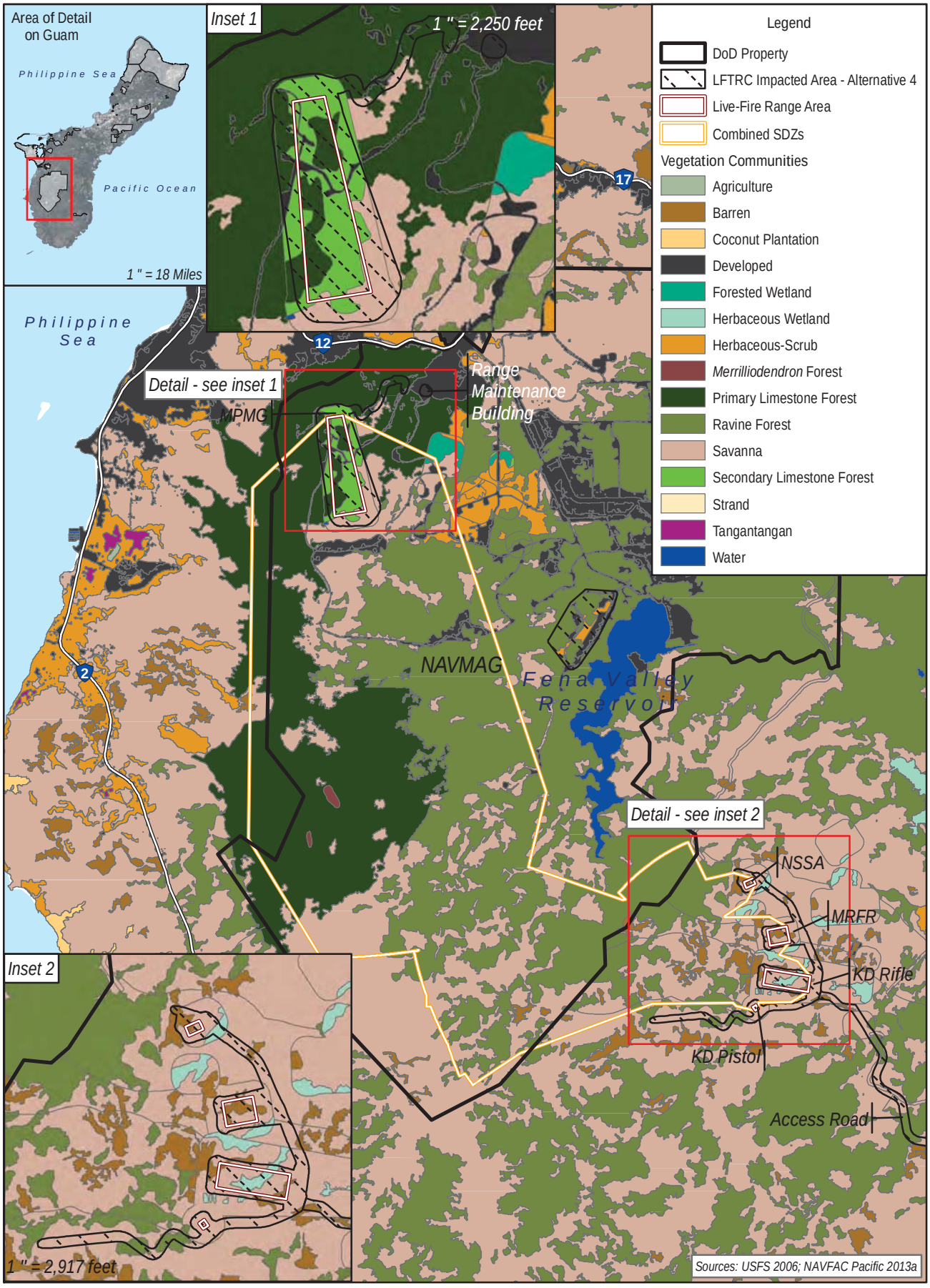


Figure 5.4.8-1
Vegetation Communities -
NAVMAG (L-Shaped) LFTRC Alternative

Special-Status Species: Federal ESA-Listed and Proposed Species

Three ESA-listed species (Mariana fruit bat, Mariana common moorhen, and Mariana swiftlet) and three proposed species (Mariana eight-spot butterfly, *Tabernaemontana rotensis*, and *Cycas micronesica*) occur within the proposed Alternative 4 action area, including the proposed access road (Table 5.4.8-1 and see Figure 5.2.8-3). Further detail on each species can be found in the previous discussions for Alternative 2 (Section 5.2.8) and Alternative 3 (Section 5.3.8). Although "suitable habitat" for special-status species is present within the Alternative 4 project areas, the brown treesnake, the primary factor in the extirpation of special-status wildlife species on Guam and one of the largest obstacles to achieving recovery of special-status species, is still considered abundant and widespread on Guam. Until brown treesnakes are suppressed or removed from at least targeted areas on Guam, the habitat is not in a suitable condition to support the survival of special-status species due to current snake abundance on Guam (e.g., Guam Micronesian kingfisher, Guam rail, Mariana crow) (USFWS 2010a).

MARIANA FRUIT BAT. After 1996, an estimated 5-20 individual Mariana fruit bats were thought to occur within the NAVMAG/Upper Talofofo Watershed, and were assumed to be full time residents of the area, rather than migrants from the main Pati Point Colony on AAFB in northern Guam (Morton and Wiles 2002). USFWS (1996) speculated that disturbance associated with illegal hunting may have inhibited the establishment of a communal roost within the NAVMAG. Currently, fruit bats are only occasionally observed at the NAVMAG. During dawn and dusk observations on 42 different days between February and July 2008, only one bat was sighted along Almagosa Road (Brooke 2008). During 2012 surveys within the northern portion of the Alternative 4 action area for this SEIS, solitary Mariana fruit bats were observed within ravine forest on 6 separate days (Figure 5.4.8-2a) (NAVFAC Pacific 2013a). The sightings were generally within the same area and just north of the Brooke (2008) observation.

Although suitable foraging and roosting habitat occurs within the southern portion of the Alternative 4 action area, particularly within the proposed SDZs within NAVMAG, surveys within and in the vicinity of the proposed range areas on non-federal lands in 2012 did not observe any Mariana fruit bats (NAVFAC Pacific 2013a). As fruit bats are known to travel 6-7.5 miles (10-12 km) to reach forage areas (USFWS 1990), and the proposed southern portion of the Alternative 4 action area contains suitable roosting and foraging habitat (particularly within the SDZ; Figure 5.4.8-2b), there is the potential for fruit bats within NAVMAG to travel to suitable habitat within the southern portion of the Alternative 4 action area. Fruit bat recovery habitat is found within proposed project impacted areas and SDZs associated with Alternative 4 (see Figure 3.8.3-1).

Table 5.4.8-1. Distribution of Special-Status Species on the NAVMAG and non-Federal Lands Associated with the NAVMAG (L-Shaped) LFTRC Alternative

Name	*Status**		*Habitat*	*Known to Occur*	*Comments*
	ESA	*Guam*			
Mammals					
Mariana fruit bat[b, c, d, e, h, i, k, m, q, r]	T	E	Limestone forest, ravine forest, coastal forest, and coconut plantations.	Yes	2008 and 2012 surveys: observations of single individuals in SDZ of northern range area during; recovery habitat present.
Birds					
Mariana common moorhen[c, d, f, h, m, q]	E	E	Freshwater wetlands.	Yes	Observed in two ponds in northern range area during 2012 surveys and present at Fena Reservoir.
Mariana swiftlet[c, d, h, i, q]	E	E	Nests in caves; feeds over savannah and ravine forest.	Yes	Observed during 2012 surveys in the southern range area.
Mariana crow[a, d, h, m, q, r]	E	E	All forests with a preference for native limestone forest.	No	Extirpated from Guam – last seen in southern Guam in the mid-1960s; recovery habitat present.
Guam Micronesian kingfisher[a, d, h, j, m, q, r]	E	E	Forest and scrub with a preference for native limestone forest.	No	Extirpated from the wild on Guam by 1985; last seen in southern Guam in the 1970s; recovery habitat present.
Guam rail[a, d, h, l, n, p, q, r]	E	E	Secondary habitats, some use of savanna and limestone forests.	No	Extirpated from the wild on Guam by 1988; last seen in southern Guam in the 1970s; recovery habitat present.
Reptiles					
Pacific slender-toed gecko[c, d, h]	-	E	Forest edge.	Yes	2012 surveys: observed in impacted areas and SDZs.
Moth skink[c, d, h, i]	-	E	Forest areas with large tree trunks.	Yes	2008, 2009, and 2012 surveys: not observed in impacted areas; observed only within SDZs.
Slevin's skink[i, t]	PE	E	Mid-elevation closed humid and montane forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Invertebrates					
Mariana eight-spot butterfly[i, n, t]	PE	-	Limestone forest with host plants.	Yes	2012 surveys: host plants documented within impacted areas and adult within SDZs.
Mariana wandering butterfly[i, s, t]	PE	-	Larvae feed on one known host plant species found in native limestone forest habitat.	No	Has not been seen on Guam since 1979 and considered extirpated; host plants not observed during 2012 surveys of the impacted areas.
Guam tree snail[c, d, g, h, i, t]	PE	E	Cool shaded forested areas with high humidity.	No	2009 and 2012 surveys: not observed in impacted areas.
Humped tree snail[c, d, g, h, i, t]					
Fragile tree snail[c, d, g, h, i, o, t]					
Plants					
Serianthes tree[d, h, m, q, r]	E	E	Limestone and ravine forests.	No	2008, 2009, and 2012 surveys: not observed in impacted areas or SDZs; recovery habitat present.
Heritiera longipetiolata[d, h, q, t]	-	E	Limestone forest.	Yes	2008, 2009, and 2012 surveys: not observed in impacted areas; observed only within SDZs.

Name	***Status****		***Habitat***	***Known to Occur***	***Comments***
	ESA	*Guam*			
Cyathea lunulata[d, h, q]	-	E	Wet ravines at the boundary with savanna in southern Guam.	No	2008, 2009, and 2012 surveys: not observed in impacted areas or SDZs.
Cycas micronesica[d, q, t]	PE	SOGCN	Limestone and ravine forests, and savanna summits.	Yes	2012 surveys: observed within impacted areas and SDZs.
Merrilliodendron megacarpum[d, q]	-	SOGCN	Native limestone forest.	Yes	
Tabernaemontana rotensis[d, q, t]	PT	SOGCN	Native limestone forest.	Yes	
Bulbophyllum guamense[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Eugenia bryanii[i, t]	PE	-	Windy exposed coastal clifflines in lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Maesa walkeri[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Nervilia jacksoniae[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Psychotria malaspinae[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Solanum guamense[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Tinospora homosepala[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Tuberolabium guamense[i, t]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas; observed on the NAVMAG during surveys for 2010 EIS but outside the current proposed impacted areas.
Hedyotis megalantha[i, t]	PE	-	Savanna	No	NR; not observed in 2012 surveys in the impacted areas.
Dendrobium guamense[i, t]	PE	-	Limestone forests	No	NR; not observed in 2012 surveys in the impacted areas.
Phyllanthus saffordii[i, t]	PE	-	Savanna	No	NR; not observed in 2012 surveys in the impacted areas.

Legend: *E = endangered, PE = proposed endangered, PT = proposed threatened, T = threatened.
Sources: [a]Jenkins 1983; [b]USFWS 1990; [c]COMNAV Marianas 2001; [d]GDAWR 2006; [e]Brooke 2008; [f]Brooke and Grimm 2008; [g]Smith *et al.* 2008; [h]GovGuam 2009; [i]NAVFAC Pacific 2013a; [j]USFWS 2008b; [k]USFWS 2009a; [l]USFWS 2009b; [m]USFWS 2011; [n]USFWS 2012a; [o]USFWS 2012c; [p]BirdLife International 2013; [q]JRM 2013; [r]USFWS 2010b; [s]USFWS 2012d; [t]USFWS 2014a, 2014b.

MARIANA COMMON MOORHEN. Although freshwater wetlands were common in the southern portion of the Alternative 4 action area, open water habitat was not observed in the impacted area during 2012 surveys. Stinson *et al.* (1991) observed four moorhens on a seasonal pond approximately 400 feet (90 m) east of the proposed MRF Range boundary (see Figure 5.2.8-3). During surveys in June 2012, this area was observed to be a dry, well-vegetated, elongated basin several hundred feet long. It is possible some seasonal ponds could be present in very wet periods, but open water would likely be present for only a very short period.

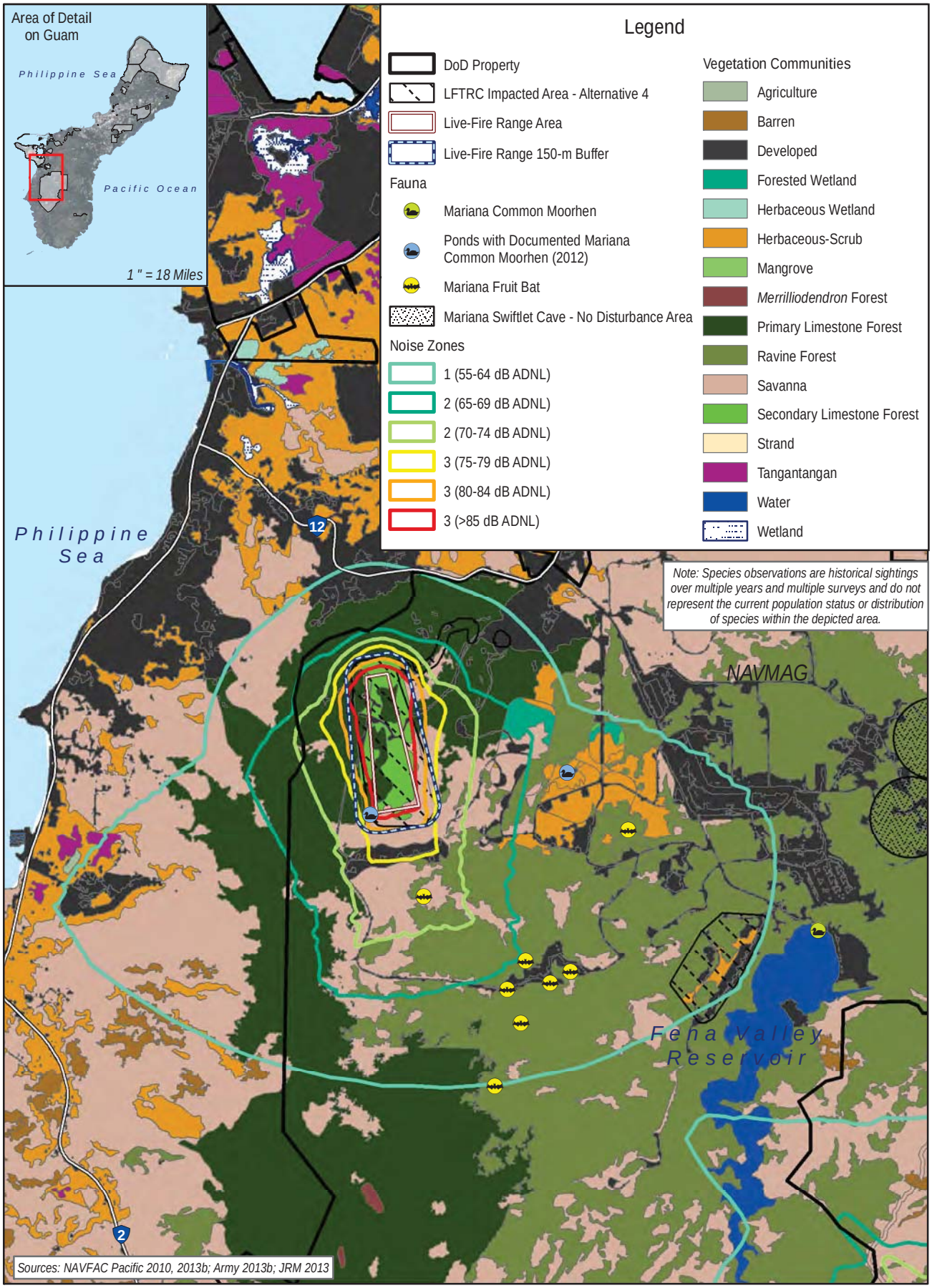


Figure 5.4.8-2a
Vegetation Communities and Mariana Common Moorhen and Mariana Fruit Bat Observations within Small Arms ADNL Noise Zones - Northern Portion of NAVMAG (L-Shaped) LFTRC Alternative

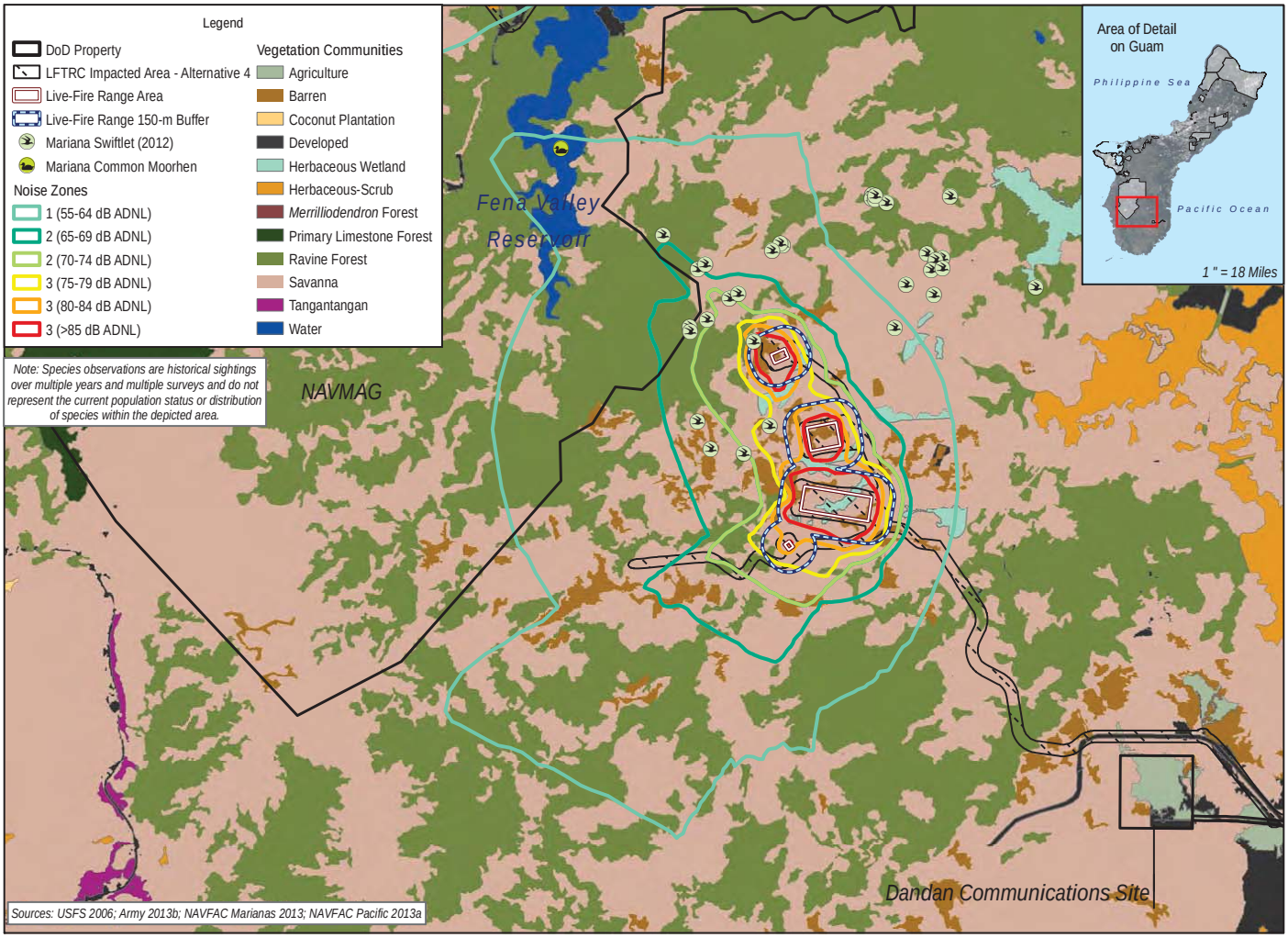


Figure 5.4.8-2b
Vegetation Communities and Mariana Swiftlet Observations
within Small Arms ADNL Noise Zones - Southern Portion of NAVMAG (L-Shaped) LFTRC Alternative

Surveys in 2012 within the Alternative 4 action area documented moorhens on two ponds (see Figure 5.4.8-2a). A single moorhen was observed on 2 separate days on a pond east of the proposed range in the northern portion of the Alternative 4 action area (NAVFAC Pacific 2013a). A single moorhen was also observed on 1 day on a pond located in the southwest corner of the northern range area associated with the proposed MPMG Range.

MARIANA SWIFTLET. Swiftlets nest and roost in caves and leave the caves during the day to forage over a wide variety of terrain and vegetation, favoring ridge crests and open grassy areas where they capture small insects while flying (USFWS 1991). There are only three known nesting/roosting caves (Mahlac, Fachi, and Maemong) on Guam for this species and they are located in the northern NAVMAG approximately 2 miles (3.2 km) east of the northern portion of the Alternative 4 action area (see Figure 5.2.8-3).

During June and July 2012, surveys within the southern portion of Alternative 4 range area observed 1-11 Mariana swiftlets at multiple locations from 4 survey stations (see Figure 5.4.8-2b) (NAVFAC Pacific 2013a). All Mariana swiftlet observations were between 1.5 and 2.3 miles (2.4-3.7 km) from the three known nesting/roosting caves in the northeastern portion of NAVMAG.

MARIANA CROW. The Mariana crow was last observed in southern Guam in the mid-1960s (USFWS 2005). Since 2009, the population on Guam consisted only of two males on AAFB, occurring primarily within the MSA (USFWS 2009c). However, as of 2012, the Mariana crow is considered extirpated in the wild on Guam (Personal communication via letter from USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, HI regarding the DON NOI for Proposed Placement of LFTRC on Guam NWR; December 7, 2012). The closest population of crows is on the island of Rota, approximately 56 miles (90 km) north of Guam. Crows in northern Guam used primary limestone forest for nesting, with nests exclusively in native trees. They have been observed foraging in both primary and secondary limestone forests and tangantangan (USFWS 2005). Crow recovery habitat is found within proposed project impacted areas and SDZs associated with Alternative 4 (see Figure 3.8.3-1).

GUAM RAIL. The Guam rail was last seen in southern Guam in the 1970s, and was extirpated in the wild by 1985. It exists primarily in captivity on Guam and in mainland zoos. Experimental populations of Guam rails were introduced onto Rota, CNMI in 1989 and onto Cocos Island, off the southern coast of Guam, in 2011 (USFWS 2009b; BirdLife International 2013). The Guam rail prefers edge habitats, especially grassy or secondary vegetation areas that provide good cover; mature forest is deemed only marginal for the Guam rail (USFWS 2009b). Rail recovery habitat is found within proposed project impacted areas associated with Alternative 4 (see Figure 3.8.3-2).

GUAM MICRONESIAN KINGFISHER. The Guam Micronesian kingfisher was last seen in southern Guam in the 1970s, and was extirpated in the wild by 1988. It is now found only in captivity on Guam and at mainland zoos (USFWS 2008). Kingfishers utilized a wide variety of habitats including primary and secondary limestone forest, strand forest, coconut forest, edge habitats, and forest openings, but mature forests with tree cavities suitable for nesting may be an important requirement for kingfisher reproduction (USFWS 2008). Kingfisher recovery habitat is found within proposed project impacted areas and SDZs associated with Alternative 4 (see Figure 3.8.3-1).

SLEVIN'S SKINK. Originally found on Guam, Cocos Island, Rota, Tinian, Guguan, Alamagan, Asuncion, and Maug, it is now limited to Cocos Island, Sarigan, Guguan, Alamagan, Pagan, and Asuncion. Slevin's skink has not been recorded on Guam since 1945 and is believed to be extirpated from Guam; it is now known to occur only on Cocos Island (an atoll south of Guam) (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 4 (USFWS 2014b). Therefore, as Slevin's skink is not found within the impacted areas of Alternative 4, this species is not addressed further.

MARIANA EIGHT-SPOT BUTTERFLY. Although adults, larvae, or eggs of the Mariana eight-spot butterfly were not observed during 2012 surveys within the action area, one large patch and numerous small patches of the host plant *Procris pedunculata* were observed and mapped within the proposed MPMG Range footprint or 328-foot (100-m) buffers within the northern portion of the Alternative 4 action area (see Figure 5.2.8-3) (NAVFAC Pacific 2013a).

TREE SNAILS. The three proposed endangered tree snail species (Guam tree snail, humped tree snail, and fragile tree snail) were not observed during field surveys conducted within the proposed Alternative 4 action area in 2009 in support of the 2010 Final EIS and in 2012 in support of this SEIS (NAVFAC Pacific 2010, 2013a, 2013b). In 2008, the Guam tree snail was observed 700 feet (210 m) northwest of the proposed magazine relocation area and approximately 3,000 feet (914 m) southeast of the Non-standard Small Arms range area (see Figure 5.2.8-3) (Smith *et al.* 2008), outside of the Alternative 4 impacted area and SDZ. Therefore, as the tree snail species are not found within the Alternative 4 impacted areas, these species are not addressed further.

SERIANTHES TREE. The endangered *Serianthes* tree was not observed during field surveys conducted within the proposed Alternative 4 action area in 2009 in support of the 2010 Final EIS and in 2012 in support of this SEIS (NAVFAC Pacific 2010, 2013a, 2013b). The only known location on Guam of the *Serianthes* tree is on AAFB, more than 20 miles (32 km) north of the NAVMAG. However, *Serianthes* recovery habitat is found within proposed project impacted areas and SDZs associated with Alternative 4 (see Figure 3.8.3-2).

TABERNAEMONTANA ROTENSIS AND *CYCAS MICRONESICA*. During 2012 surveys, one area of *C. micronesica* and one specimen of *T. rotensis* were observed within the impacted area of the proposed MPMG Range (see Figure 5.2.8-3).

HERITIERA LONGIPETIOLATA. This endemic tree is found in crevices of rough limestone in primary limestone forest (USFWS 2014a). Field surveys for the 2010 Final EIS (NAVFAC Pacific 2010) and in 2012 for this SEIS (NAVFAC Pacific 2013a) did not find *H. longipetiolata* within the proposed range areas under Alternative 4. Two locations of *H. longipetiolata* are known from the southern portion of the proposed SDZ and one occurrence is just south of the proposed munitions magazine relocation area (see Figure 5.2.8-3). As *Heritiera longipetiolata* has not been observed within the impacted areas of Alternative 4, this species is not addressed further.

BULBOPHYLLUM GUAMENSE. An epiphyte in the orchid family, this species occurs in mat-like formations on tree branches of coastal lowland/limestone forests. Currently, there are 8 known occurrences on Guam totaling fewer than 250 individuals (USFWS 2014)a. There are no records of the species within the impacted areas of Alternative 4 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *B. guamense* is not found within the impacted areas of Alternative 4, this species is not addressed further.

EUGENIA BRYANII. A perennial shrub in the myrtle family, the species is known only from the island of Guam. Historically, *E. bryanii* is known from windy exposed coastal clifflines and along the Pigua River,

in lowland/limestone forests. Currently, *E. bryanii* is known from 6 occurrences totaling fewer than 420 individuals (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 4 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *E. bryanii* is not found within the impacted areas of Alternative 4, this species is not addressed further.

MAESA WALKERI. A shrub or small tree in the primrose family typically found in limestone forests, this species is known from only two individuals on Guam, one of which is located along the southwestern border of the NAVMAG (Figure 5.2.8-3) (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 4 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *M. walkeri* is not found within the impacted areas of Alternative 4, this species is not addressed further.

NERVILIA JACKSONIAE. A small herb in the orchid family, this species is found in lowland/limestone forests. On Guam, *N. jacksoniae* is known from 2 occurrences totaling fewer than 200 individuals (USFWS 2014). There are no records of the species within the impacted areas of Alternative 4 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *N. jacksoniae* is not found within the impacted areas of Alternative 4, this species is not addressed further.

PSYCHOTRIA MALASPINAE. A shrub or small tree in the coffee family, this species is found in lowland/limestone forests. Currently, *P. malaspinae* is known from 5 occurrences: 1 individual at Ritidian Point within the Guam NWR, 1 individual at Pågat Point, 1 individual at the base of Mt. Almagosa, and 2 individuals at NWF (USFWS 2014a, 2014b). None of these individuals have been observed within the last 5 years (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 4 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *P. malaspinae* is not found within the impacted areas of Alternative 4, this species is not addressed further.

SOLANUM GUAMENSE. A small shrub in the nightshade family that occurs within limestone forests. Currently, *S. guamense* is known from a single occurrence of one individual on Guam (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 4 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *S. guamense* is not found within the impacted areas of Alternative 4, this species is not addressed further.

TINOSPORA HOMOSEPALA. A vine in the moonseed family found in limestone forests. Currently, *T. homosepala* is known from 3 occurrences totaling approximately 300 individuals (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 4 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *T. homosepala* is not found within the impacted areas of Alternative 4, this species is not addressed further.

TUBEROLABIUM GUAMENSE. An epiphyte in the orchid family found in limestone forests. Currently, *T. guamense* is known from 3 occurrences on Guam: 2 occurrences within the NAVMAG (1 occurrence in the forest ecosystem of the Mt. Almagosa cliffline and 1 south of the swiftlet caves) (see Figure 5.2.8-3) and 1 at Finegayan (NAVFAC Pacific 2010; USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative 4 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *T. guamense* is not found within the impacted areas of Alternative 4, this species is not addressed further.

DENDROBIUM GUAMENSE. An epiphyte in the orchid family, the species occurs within lowland/limestone forests and savanna. On Guam, there are 4 occurrences totaling fewer than 250 individuals (USFWS 2014a). There is 1 known occurrence within the NAVMAG within the vicinity of Almagosa Springs (see Figure 5.2.8-3). There are no records of the species within the impacted areas of Alternative 4 (USFWS

2014b). Therefore, as *D. guamense* is not found within the impacted areas of Alternative 4, this species is not addressed further.

HEDYOTIS MEGALANTHA. A perennial herb in the coffee family, this species occurs in savanna areas in southern Guam. Currently, *H. megalantha* is known from one large scattered occurrence totaling fewer than 1,000 individuals on southern Guam, between Mt. Alutom and Tarzan Falls. This species typically occurs as lone individuals rather than in patches or groups (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 4 (USFWS 2014b). Therefore, as *H. megalantha* is not found within the impacted areas of Alternative 4, this species is not addressed further.

PHYLLANTHUS SAFFORDII. This woody shrub is currently known from four scattered occurrences on southern Guam within savanna areas: Mt. Alutom, Piti Hills, Nimitz Hill "War in the Pacific Lookout," and near the Cetti Bay Watershed (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 4 (USFWS 2014b). Therefore, as *P. saffordii* is not found within the impacted areas of Alternative 4, this species is not addressed further.

Special-Status Species: Guam-Listed Species and SOGCN

Two Guam-listed endangered species (Pacific slender-toed gecko and moth skink) and one SOGCN (*Merrilliodendron megacarpum*) occur within the Alternative 4 action area (see Table 5.4.8-1). Those species that are also listed or proposed for listing under the federal ESA were discussed above.

PACIFIC SLENDER-TOED GECKO. Field surveys in 2012 (NAVFAC Pacific 2013a) documented the Pacific slender-toed gecko within the footprint of the proposed MPMG Range within the northern portion of the Alternative 4 action area (see Figure 5.2.8-3). Surveys conducted in 2008 and 2009 in support of the 2010 Final EIS, and within the Alternative 4 action area, also observed the Pacific slender-toed gecko within the proposed SDZs associated with Alternative 4 (NAVFAC Pacific 2010).

MOTH SKINK. The moth skink was not observed during surveys conducted in 2012 in support of this SEIS within the proposed range footprints under Alternative 4 (NAVFAC Pacific 2013a). Surveys conducted in 2008 and 2009 for the 2010 Final EIS, and within the Alternative 4 action area, observed the moth skink only within the SDZs associated with the Alternative 4 action area (see Figure 5.2.8-3) (NAVFAC Pacific 2010). As the moth skink has only been observed within the proposed SDZs of Alternative 4, and there would be no ground-disturbing activities within the SDZ, this species is not addressed further.

CYATHEA LUNULATA. Field surveys for the 2010 Final EIS (NAVFAC Pacific 2010) and in 2012 for this SEIS (NAVFAC Pacific 2013a) did not find the tree fern *C. lunulata* within the proposed range areas under Alternative 4. As the tree fern has not been observed within the impacted areas associated with Alternative 4, this species is not addressed further.

MERRILLIODENDRON MEGACARPUM. During 2012 surveys, several small patches of *M. megacarpum* was observed within the northern impacted area of Alternative 4 (Figure 5.2.8-3). *M. megacarpum* is considered an SOGCN because of its rarity and potential threats from ungulate damage, typhoons, development, and insect infestation (GDAWR 2006). *M. megacarpum* also is present in large patches within primary limestone forest in the west-central area of the SDZs (see Figure 5.2.8-3).

5.4.8.2 Environmental Consequences

Construction

Vegetation. The construction of the ranges and access road on NAVMAG and non-federal lands under Alternative 4 would impact areas dominated by savanna (172 acres [70 ha]), with an additional 130 acres

(53 ha) of limestone forest, 101 acres (41 ha) of developed/barren areas, 62 acres (25 ha) of ravine forest, 19 acres (8 ha) of herbaceous scrub, and 7 acres (3 ha) of wetlands, and 7 acres (3 ha) of agricultural land (see Figure 5.4.8-1 and Table 5.4.8-2).

Table 5.4.8-2. Direct Impacts to Vegetation Communities with Implementation of LFTRC Alternative 4

Project Component	*Vegetation Community (acres [ha])*								
	PLF	***SLF***	***RF***	***HW***	***HS***	***Sav***	***Dev/Bar***	***Ag***	***Total***
Range Areas, Associated Features, & Dandan Access Rd.	47.8 (19.3)	63.2 (25.6)	17.6 (7.1)	7.4 (3.0)	7.5 (3.0)	172.0 (69.6)	75.0 (30.4)	7.2 (2.9)	**397.7 (160.9)**
Magazine Relocation	0	0	44.7 (18.1)	0	9.8 (4.0)	0	24.4 (9.9)	0	**78.9 (31.9)**
HG Range (at Andersen South)	19.4 (7.9)	0	0	0	1.8 (0.7)	0	1.8 (0.7)	0	**23.0 (9.3)**
Total	**67.2 (27.2)**	**63.2 (25.6)**	**62.3 (25.2)**	**7.4 (3.0)**	**19.1 (7.7)**	**172.0 (69.6)**	**101.2 (41.0)**	**7.2 (2.9)**	**499.6 (202.2)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; RF = ravine forest; HW = herbaceous wetland; HS = herbaceous scrub; Sav = savannah; Dev/Bar = developed/barren; Ag = agriculture.

Based on surveys conducted in 2012 in the proposed range areas, the ravine forest community is significantly degraded in many areas due to invasion by non-native woody species including *Vitex* and betelnut palm, and heavy infestation by herbaceous non-native invasive plants (NAVFAC Pacific 2013a). Impacts to vegetation from construction of the proposed HG Range at Andersen South were discussed in Section 5.1.8.2 and were found to be less than significant.

Native limestone forest, both primary and secondary, has been significantly reduced on Guam due to past and ongoing actions including extensive disturbance during and after WWII, widespread planting of non-native species; and impacts from non-native ungulates; development; fire; and deforestation. As stated in Section 3.8.1.1, limestone forests on Guam are important since they retain the functional ecological components of native forest that provide habitat for the majority of Guam's native species, including ESA-listed, ESA-proposed, and Guam-listed species, and Guam SOGCN, as well as quality and reducing fire risk. Non-native forest communities (e.g., tangantangan, *Vitex*) significantly alter the forest structure, composition, and resilience to other disturbance processes and do not provide the conditions suitable for native flora and fauna species to persist (Morton *et al.* 2000; GDAWR 2006; Guam Department of Agriculture 2010; JRM 2013).

Of the 18,538 acres (7,502 ha) of primary and secondary limestone forest found on Guam, approximately 13,110 acres (5,305 ha) are found primarily within AAFB, Finegayan, and NAVMAG (USFS 2006). Under Alternative 4, 67 acres (27 ha) of primary limestone forest, 63 acres (26 ha) of secondary limestone forest, and 62 acres (25 ha) of ravine forest would be removed (see Table 5.4.8-2). Ravine forest is also an important community type for native species in southern Guam. Therefore, given the importance of limestone and ravine forest habitats for native species and the continuing loss of native forests across Guam, the conversion of 193 acres (78 ha) of limestone and ravine forest on NAVMAG to developed area would be a significant but mitigable impact to the regional vegetation community and its function.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on vegetation communities with implementation of Alternative 4. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Potential Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the contractor education program.
- *Onsite Vegetation Waste Management Procedures.* See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the vegetation waste management procedures.
- *DON Guam Landscaping Guidelines*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of landscaping guidelines.
- *LFTRC Range Berm Controls.* To manage stormwater runoff and control erosion, LFTRC range berms would contain native or non-invasive herbaceous vegetation and other engineering controls.
- *Contractor Plans and Specifications*. All construction would occur within the limits of construction shown in the project figures.

Potential Mitigation Measures

To mitigate for significant impacts to limestone forest, the DON proposes to implement forest enhancement on a minimum of 193 acres (78 ha) of limestone and ravine forest. Forest enhancement would include but is not limited to the following actions:

- Ungulate management consisting of exclusion fencing and active control (i.e. trapping, snaring, shooting) with the goal of eradication within the fenced areas.
- Non-native, invasive vegetation removal.
- Propagation, planting, and establishment of native species that are characteristic of native limestone forest habitats (e.g., *A. mariannensis, G. mariannae, F. prolixa, M. citrifolia, W. elliptica*).

The degradation and loss of primary limestone and other forest habitats resulting from ungulate damage and invasion by alien plant species has substantially diminished the extent of habitat for native species in the Mariana archipelago. The anticipated benefit of implementing these potential mitigation measures is improved habitat quality for native flora and fauna, including special-status species. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Terrestrial Conservation Areas. The only terrestrial conservation area within the impacted areas of Alternative 4 is Overlay Refuge. Overlay Refuge lands were established for the purpose of conserving and protecting ESA-listed species and other native flora and fauna, maintaining native ecosystems, and the conserving native biological diversity, recognizing that the primary purpose of lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force.

Approximately 219 acres (88 ha) of Overlay Refuge lands (Table 5.4.8-3), or 1% of the total Overlay Refuge lands on Guam, would be directly impacted under Alternative 4. This area overlaps with the vegetation communities discussed previously. The majority (102 acres [41 ha]) is comprised primarily of limestone forest (Table 5.4.8-3). Therefore, because proposed construction activities would convert 219 acres (88 ha) of Overlay Refuge lands to developed areas, this would be a significant loss to the

conservation function of these lands and implementation of Alternative 4 would result in significant but mitigable impacts to terrestrial conservation areas.

Table 5.4.8-3. Impacts to Overlay Refuge with Implementation of LFTRC Alternative 4

Project Component	*Overlay Refuge (acres [ha])*						
	PLF	***SLF***	***RF***	***HS***	***Sav***	***Dev/Bar***	***Total***
Range Areas, Associated Features, & Dandan Access Rd.	39.3 (15.9)	63.2 (25.6)	0.1 (<0.1)	0	30.2 (12.2)	7.0 (2.8)	**139.8 (56.6)**
Magazine Relocation	0	0	44.7 (18.1)	9.8 (4.0)	0	24.4 (9.9)	**78.9 (31.9)**
HG Range (at Andersen South)	0	0	0	0	0	0	**0**
Total	**39.3 (15.9)**	**63.2 (25.6)**	**44.8 (18.1)**	**9.8 (4.0)**	**30.2 (12.2)**	**31.4 (12.7)**	**218.7 (88.5)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; RF = ravine forest; HS = herbaceous scrub; Sav = savannah; Dev/Bar = developed/barren.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on terrestrial conservation areas with implementation of Alternative 4. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

The same BMPs discussed above under *Vegetation* would be implemented for terrestrial conservation areas.

Potential Mitigation Measures

To mitigate for significant impacts to terrestrial conservation areas, the DON would submit a proposal to CNO Energy and Environmental Readiness Division to designate an ERA on the NAVMAG to conserve native limestone forest in southern Guam which provides habitat for special-status species. The DON has defined an ERA as a physical area or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural, physical, and biological processes to prevail without human intervention. However, under unusual circumstances, deliberate manipulation (e.g., removal or control of invasive species) may be utilized to maintain the unique feature that the ERA was established to protect (NAVFAC 1996). The proposed NAVMAG ERA would encompass approximately 553 acres (234 ha). Although the proposed NAVMAG ERA is currently part of the Overlay Refuge, implementation of these potential mitigation measures would provide an increased level of protection by further ensuring this area is maintained in natural and near natural conditions and to have available such areas for research and scientific manipulation (NAVFAC 1996; NAVFAC Marianas 2010).

In addition, the DON proposes to submit a proposal to CNO Energy and Environmental Readiness Division to expand the existing Orote ERA by approximately 32 acres (13 ha) of terrestrial habitat. The Final Orote ERA Expansion proposal was completed FY 2013 and will be submitted for approval in 2014.

Wildlife - Native Species. Short-term construction noise may temporarily impact suitable habitat for native birds in the vicinity of the construction areas, but they would relocate to other areas of suitable habitat in the vicinity, and could return to the area following construction. Non-listed native reptiles are abundant throughout Guam and impacts to vegetation communities under Alternative 4 would result in less than significant impacts to non-listed native reptile populations. Implementation of Alternative 4 would not

have a significant adverse effect on a population of any migratory bird species or other native wildlife species. Impacts to wildlife from the construction of the HG Range at Andersen South were discussed in Section 5.1.8.2 and impacts would be less than significant.

Therefore, as presented above, long-term, direct impacts to populations of native wildlife species would not result because these species are abundant in surrounding areas and could repopulate portions of suitable habitat within the affected area after construction. Therefore, direct impacts to native wildlife species would be less than significant with implementation of proposed construction activities associated with Alternative 4.

Proposed construction activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. To prevent the inadvertent spread of non-native species on Guam or to other locations off of Guam, the DON would implement standard biosecurity measures (e.g., HACCP, brown treesnake interdiction measures, coconut rhinoceros beetle vegetation management procedures, and outreach/education) into construction protocols, procedures, and activities.

The following BMPs would be implemented to avoid and minimize potential direct, long-term impacts of proposed construction activities on native wildlife with implementation of Alternative 4.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

With implementation of these BMPs, including development of HACCP plans and ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species (e.g., coconut rhinoceros beetle), the potential for the introduction of new or spread of existing non-native species on Guam is substantially reduced. Therefore, there would be less than significant impacts to native wildlife species related to the potential introduction and establishment of non-native species with implementation of proposed construction activities associated with Alternative 4.

Damage of forested areas, particularly primary and secondary limestone forests, by non-native ungulates (i.e., deer, pigs) is a serious concern on Guam. Under Alternative 4, removal of large amounts of limestone forest currently used by ungulates would displace and concentrate ungulates into adjacent areas, resulting in even higher densities and potentially greater habitat damage. Potential impacts from changes in ungulate densities from construction projects within the same or similar habitat areas as proposed in this SEIS were addressed in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-115).

The implementation of the potential mitigation measures under the *Vegetation* section above would also benefit native wildlife species. In particular, the objectives of ungulate management,

control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

Special-Status Species: Federal ESA-Listed and Proposed Species

Impacts to special-status species from the construction of the HG Range at Andersen South were discussed in Section 5.1.8.2 and were determined to be less than significant. The following discussion addresses those species that occur within the Alternative 4 action area.

MARIANA FRUIT BAT. Approximately 161 acres (65 ha) of Mariana fruit bat recovery habitat would be removed due to proposed construction activities at NAVMAG under Alternative 4. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Additional potential direct temporary impacts to the Mariana fruit bat from construction activities are based on the distances from those activities that are likely to cause disturbance to this species (e.g., noise, human activity, lighting). The evaluation of fruit bat disturbance is based on the approach used by USFWS in previous ESA section 7 formal consultations and associated BOs (e.g., USFWS 2006b, 2010). These distances are: roosting habitat within 492 feet (150 m) and foraging habitat within 328 feet (100 m) from the activity (Wiles, personal communication 2006 and Janeke, personal communication 2006, respectively, as cited in USFWS 2006b).

The species is currently limited to the few areas on Guam away from human activities and with suitable habitat, primarily on federal lands on the NAVMAG and AAFB (JRM *et al.* 2012a, 2012b; JRM 2013; A. Brooke, NAVFAC Marianas, personal communication). However, illegal hunting, loss and degradation of native forest, predation by the brown treesnake, and the increased extirpation risk owing to the high vulnerability of very small populations continue to limit the potential recovery of the species on Guam (USFWS 2010; JRM 2013). Based on the equilibrium/carrying capacity of snakes on Guam (Rodda and Savidge 2007), implementation of the proposed action is not expected to increase the likelihood of predation by the brown treesnake on Mariana fruit bats.

Although the loss of 161 acres (65 ha) of fruit bat recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, it would reduce the total number of bats that the island can support. Given this loss of recovery habitat and the critically low numbers of bats on Guam, there would be significant but mitigable impacts to the Mariana fruit bat.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on Mariana fruit bats with implementation of Alternative 4. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Pre-Construction Surveys*. Surveys would be completed within suitable fruit bat habitat 1 week prior to onset of construction activities following the USFWS-approved JRM protocol.

If a fruit bat is present within 492 feet (150 m) of the project site, the work must be postponed until the bat has left the area.

- *Lighting Installation*. Lighting would be designed to meet minimum safety and AT/FP requirements. Hooded lights would be used to the maximum extent practicable at all new roads and facilities adjacent to fruit bat habitat. Illumination of forest would be kept to an absolute minimum.

Potential Mitigation Measures

The same potential mitigation measures discussed previously under *Vegetation* (i.e., forest enhancement of 193 acres [78 ha] of limestone forest) would be applicable for the Mariana fruit bat and its recovery habitat. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana fruit bat. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

MARIANA SWIFTLET. Although the only swiftlet nest/roost caves are approximately 1 mile (1.6 km) east of the proposed northern portion of the Alternative 4 action area, surveys in 2008, 2009, and 2012 did not observe any Mariana swiftlets within the area of the northern portion of Alternative 4. Based on surveys for this SEIS as well as observations from other survey efforts, swiftlets appear to forage to the north, east and south of the caves (Morton and Amidon 1996; NAVFAC Pacific 2010, 2013a, 2013b; R. Spaulding, Cardno TEC, unpublished data).

Based on 2012 field surveys, this species forages in the proposed southeastern portion of the Alternative 4 action area, particularly in the northern area, closer to the only known swiftlet nesting/roosting caves on Guam. Swiftlets would continue to forage within the extensive foraging habitat surrounding the proposed southeastern range area of Alternative 4, including the extensive areas of savanna and ravine forest to the north, west, and east of the proposed range areas, and areas in the vicinity of the nest/roost caves on NAVMAG and the drainages of the Mahlac, Maagas, and Talofofo rivers (see Figures 5.2.8-1 and 5.2.3-3). The proposed construction activities would also not impact regional insect populations that are the prey base for the swiftlet. Although noise levels within the immediate vicinity of proposed construction activities would increase, they would be localized and temporary. Proposed construction activities would not impact the swiftlet nesting/roosting caves approximately 1 mile (1.6 km) east of the northern range and 2 miles (3.2 km) north of the proposed southeastern ranges associated with Alternative 4. Therefore, there would be less than significant impacts to the Mariana swiftlet with implementation of the proposed range construction activities under Alternative 4.

MARIANA CROW. The Mariana crow is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the crow is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the crow, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 4, impacts to the crow would be limited to recovery prospects. If crows are reintroduced and exposed to construction activities under Alternative 4, they may be disturbed (DON 2014).

Although the crow no longer occurs on Guam, approximately 166 acres (67 ha) of crow recovery habitat would be removed due to proposed construction activities under Alternative 4. This area is included in the

impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Although this loss of crow recovery habitat on Guam would not preclude the recovery of the crow should it be reintroduced to Guam in the future, it would reduce the total number of crows that the island can support. If and when the crow is reintroduced to Guam, the best available information indicates project-related noise would not further reduce the amount of recovery habitat suitable for this species' breeding, feeding and sheltering (USFWS 2010). Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Mariana crow.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of the Mariana crow with implementation of Alternative 4. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 193 acres [78 ha] of limestone forest) would be applicable for the Mariana crow and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana crow, should it be reintroduced to Guam in the future.

GUAM RAIL. The Guam rail is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the rail is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the rail, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the rail is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 4, impacts to the rail would be limited to recovery prospects. If rails are reintroduced and exposed to construction activities under Alternative 4, they may be disturbed (DON 2014).

Although the rail no longer occurs on Guam, approximately 50 acres (20 ha) of rail recovery habitat within the proposed magazine relocation area would be removed due to proposed construction activities under Alternative 4. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

This loss of rail recovery habitat on Guam would not preclude the recovery or survival of the rail should it be reintroduced to Guam in the future, and it would not substantially reduce the total number of rails that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to the Guam rail with implementation of proposed construction activities associated with Alternative 4.

The following BMPs may be implemented to avoid and reduce potential long-term impacts of proposed construction activities on the recovery of the Guam rail with implementation of Alternative 4.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

In addition, potential mitigation measures proposed above for vegetation and the Mariana crow would benefit the Guam rail.

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 193 acres [78 ha] of limestone forest) would be applicable for the rail and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam rail, should it be reintroduced to Guam in the future.

GUAM MICRONESIAN KINGFISHER. The kingfisher is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the kingfisher is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the kingfisher, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the kingfisher is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 4, impacts to the kingfisher would be limited to recovery prospects. If kingfishers are reintroduced and exposed to construction activities under Alternative 4, they may be disturbed (DON 2014).

Although the kingfisher no longer occurs on Guam, approximately 161 acres (65 ha) of kingfisher recovery habitat would be removed due to proposed construction activities under Alternative 4. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Although this loss of kingfisher recovery habitat on Guam would not preclude the recovery of the kingfisher should it be reintroduced to Guam in the future, it would reduce the total number of kingfishers that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam Micronesian kingfisher.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the recovery of the Guam Micronesian kingfisher with implementation of Alternative 4. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 193 acres [78 ha] of limestone forest) would be applicable for the rail and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam rail, should it be reintroduced to Guam in the future.

MARIANA COMMON MOORHEN. Seasonal and permanent wetlands/ponds that provide suitable habitat for moorhens (i.e., open water) are limited on Guam and the lack of sufficient wetland areas is a limiting factor in the recovery of the species. In 1991 and 2004, there were an estimated 22 seasonal or permanent wetlands on Guam that were utilized by moorhens (Stinson *et al.* 1991; Takano and Haig 2004a). Most wetlands used by moorhens on Guam, with the exception of Fena Reservoir, are less than 1.5 acres (0.6 ha) in size. Identifying essential wetlands and site fidelity are especially important since wetland habitat is increasingly very limited on Guam. Because most of the large natural wetlands are overgrown with persistent vegetation and dense monocultures of *P. karka*, moorhens are increasingly left with fewer and fewer wetlands to choose from, particularly at the onset of the dry season when seasonal wetlands begin to dry up (Stinson *et al.* 1991; Takano and Haig 2004a, 2004b).

Implementation of Alternative 4 would directly impact and remove one pond that is known to be used by 1-2 moorhens. The loss of one temporary wetland under Alternative 4 would be a less than significant impact to the Mariana common moorhen.

MARIANA EIGHT-SPOT BUTTERFLY. Although adults, larvae or eggs of the eight-spot butterfly have not observed within the Alternative 4 action area, host plants have been observed within the proposed MPMG Range in the northern portion of the Alternative 4 action area (see Figure 5.2.8-3). With implementation of appropriate BMPs to avoid and minimize potential impacts to eight-spot butterflies (e.g., pre-construction butterfly and host plant surveys within the proposed range areas and salvage/relocation of host plants; see Section 2.6), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed construction activities under Alternative 4. In addition, implementation of the potential mitigation measures described above under *Vegetation* (i.e., forest enhancement of 193 acres [78 ha] of limestone forest) would also benefit the survival the eight-spot butterfly. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species, including eight-spot butterfly host plants.

SERIANTHES TREE. Although individual *Serianthes* trees do not occur within the impacted areas of Alternative 4, approximately 19 acres (8 ha) of *Serianthes* recovery habitat would be removed due to proposed construction activities. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

This loss of *Serianthes* recovery habitat on Guam would not preclude the recovery of *Serianthes*, and it would not substantially reduce the total number of *Serianthes* that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to *Serianthes* with implementation of proposed construction activities associated with Alternative 4.

The following BMPs may be implemented to avoid and minimize, potential direct long-term impacts of proposed construction activities on the recovery of *Serianthes* with implementation of Alternative 4.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

The implementation of the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 193 acres [78 ha] of limestone forest) would benefit *Serianthes* habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

TABERNAEMONTANA ROTENSIS AND CYCAS MICRONESICA. An individual *T. rotensis* and an area of *C. micronesica* were observed within the footprint of the proposed MPMG Range (see Figure 5.2.8-3). Under Alternative 4, all *T. rotensis* and *C. micronesica* would be avoided to the maximum extent practicable during proposed construction activities. In addition, high-value (both biologically and culturally) plant species, such as *T. rotensis* and *C. micronesica* would be salvaged to the maximum extent practicable during construction activities and translocated to suitable habitat (see Section 2.8).

Therefore, with implementation of the previously mentioned BMPs (e.g., avoidance, or salvage and translocation), there would be less than significant impacts to *T. rotensis and C. micronesica* with implementation of the proposed construction activities associated with Alternative 4.

Special-Status Species: Guam-Listed and SOGCN

PACIFIC SLENDER-TOED GECKO. The Pacific slender-toed gecko is listed by Guam as endangered. This species is threatened primarily by introduced species (e.g., feral ungulates, curious skinks, musk shrews, rats, brown treesnakes, and feral cats) and loss of limestone forest habitat. The gecko is known from primary and secondary limestone forest in the Alternative 4 impacted area of the proposed MPMG Range (see Figure 5.2.8-3). The full extent of the distribution and abundance of this species throughout Guam has not been assessed. The loss of approximately 193 acres (78 ha) of occupied gecko habitat with implementation of construction activities under Alternative 4 would be a significant but mitigable impact to the Pacific slender-toed gecko.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct long-term impacts of proposed construction activities on the slender-toed gecko with implementation of Alternative 4. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

The potential forest enhancement mitigation measures described above in the *Vegetation* section would also result in a conservation benefit to the Pacific slender-toed gecko. The proposed brown treesnake research and suppression may also benefit this species. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW potential mitigation discussion for more information.

MERRILLIODENDRON MEGACARPUM. Areas of *M. megacarpum* were observed within the footprint of the proposed MPMG Range (see Figure 5.2.8-3). Under Alternative 4, all *M. megacarpum* would be avoided to the maximum extent practicable during proposed construction activities. In addition, high-value (both biologically and culturally) plant species, such as *M. megacarpum*, would be salvaged to the maximum extent practicable during construction activities and translocated to suitable habitat (see Section 2.8). Therefore, with implementation of the previously mentioned BMPs (e.g., avoidance, or salvage and translocation), there would be less than significant impacts to *M. megacarpum* with implementation of the proposed construction activities associated with Alternative 4.

Operation

Vegetation. With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, applicable elements of the SIP, and 1-year post construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of Alternative 4 is considered unlikely.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by increasing erosion, allowing for the establishment of non-native species, and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. Native plants and their habitats on Guam are adapted to a humid, tropical climate and are not adapted to a fire driven ecosystem (USFWS 2008a). Fire is a serious problem on Guam. Fire history records available from 1979 - 2002 indicate that over this 23-year period more than 16,000 fires have occurred in Guam (averaging more than 700 per year) that have burned in excess of 100,000 acres (40,469 ha), primarily in southern Guam. Of these 16,000 fires, 477 of them occurred on Naval Base Guam, primarily at Apra Harbor and NAVMAG, burning more than 9,800 acres (3,966 ha) (Nelson 2008).

As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's Wildland Fire Management Plan (Nelson 2008) (see Section 2.8). It would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions), and location and management of firebreaks, fire-fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). With implementation of the Range Fire Management Plan, which establishes management and fire suppression and emergency response procedures, potential impacts from range-related wildfires would be less than significant. The USFWS concluded in their BO for the 2010 Final EIS that they anticipated that no additional vegetation would be lost due to wildfires igniting as a result of proposed live-fire training operations (USFWS 2010a). Therefore, there would be less than significant impacts to vegetation from operation of LFTRC Alternative 4.

Terrestrial Conservation Areas. Impacts to terrestrial conservation areas from the operation of the HG Range at Andersen South were discussed in Section 5.1.8.2. As Andersen South does not contain any terrestrial conservation areas, there would be no impacts.

Modeled noise levels greater than 55 dB ADNL from proposed live-fire range operations would overlie approximately 1,525 acres (617 ha) of Overlay Refuge lands and the Bolanos Conservation Area (Table 5.4.8-4 and Figures 5.4.8-2a and 5.4.8-2b). Overlay Refuge lands were established for the purpose of conserving and protecting ESA-listed species and other native flora and fauna, maintaining native ecosystems, and the conserving native biological diversity, recognizing that the primary purpose of lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force.

Table 5.4.8-4. Noise Levels within Terrestrial Conservation Areas with Implementation of LFTRC Alternative 4 (acres [ha])

55-64 dB ADNL	*65-74 dB ADNL*	*75-85+ dB ADNL*	*Total*
734.4 (297.2)	632.3 (255.9)	158.0 (63.9)	**1,524.7** **(617.1)**

Although there would be an increase in noise associated with LFTRC activities within the northern NAVMAG, the proposed noise-generating activities would not result in a loss of the conservation function of Overlay Refuge lands and support of the national defense missions of the Navy and Air Force at the NAVMAG. While the modeled noise levels from proposed range operations may be heard within the southern portion of NAVMAG on Overlay Refuge lands and within the northern portion of the Bolanos Conservation Area (see Figure 5.4.8-2b), the noise levels would be approximately 55-64 dB ADNL or less and would be barely perceptible above ambient noise levels for the region (see Section 5.2.4, Noise). Signs would be posted along the perimeter of the SDZ notifying the public of an active live-fire range within the area behind the signs and access is restricted during operations. The Bolanos

Conservation Area is remote, difficult to access, limited to use by hikers and hunters, and management is minimal (GDAWR 2006). Therefore, there would be less than significant impacts to management or conservation values of terrestrial conservation areas with implementation of Alternative 4.

Wildlife - Native Species. Operational impacts to native wildlife would include an increase in noise and lighting. These potential impacts were evaluated in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.2: Central, page 10-129) for a similar proposed action, and were found to be not significant. With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, applicable elements of the SIP, and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the proposed LFTRC under Alternative 4 is considered unlikely. The DON recognizes the USFWS' ongoing concern regarding potential spread of the brown treesnake. The DON will consult with USFWS under ESA section 7 to determine if additional brown treesnake interdiction measures are warranted and applicable. In addition, lighting associated with the range and support areas would be hooded or shielded to the maximum extent practicable to prevent unnecessary light beyond operational areas. Therefore, there would be less than significant impacts to native wildlife with operation of the proposed LFTRC under Alternative 4.

Special-Status Species: Federal ESA-Listed and Proposed Species

MARIANA FRUIT BAT. The assessment of noise levels associated with the proposed HG Range at Andersen South was previously discussed in Section 5.1.8.2. There would be no impacts to Mariana fruit bats from noise associated with operation of the HG Range.

For those species of fruit bats that have been tested for hearing sensitivity, their audiograms are very similar to those of humans, with similar upper and lower frequency limits and hearing threshold levels (Calford *et al.* 1995; Koay *et al.* 1998; Heffner *et al.* 2006). Therefore, it is likely that noise from live-fire operations at the proposed ranges would be heard by fruit bats as it would be heard by humans.

The USFWS established 60 dB and 93 dB as two thresholds of biological significance based on their review of impacts of noise to wildlife. Noise levels above 60 dB have been found to affect acoustic communication, breeding biology, survival of young, and non-auditory bird and mammal physiology. Noise levels above 93 dB may temporarily or permanently affect hearing (USFWS 2010a). No species would be exposed to noise levels of 93 dB or greater under the proposed action. While noise levels may approach 93 dB in the immediate vicinity of the firing of an individual weapon, fruit bats or other wildlife species would not be in proximity to the live-fire event given the location and nature of weapons firing within a developed range area.

Responses to noise can vary among individuals as a result of habituation where after a period of exposure to a stimulus, an animal stops responding to the stimulus. In general, a species can often habituate to human-generated noise when the noise is not followed by an adverse impact. Even when a species appears to be habituated to a noise, the noise may produce a metabolic or stress response (increased heart rate results in increased energy expenditure) though the response may or may not lead to changes in overall energy balance. Anthropogenic noise disturbance is known to alter animal behavioral patterns and lead to population declines (Barber *et al.* 2011; Francis and Barber 2013; McGregor *et al.* 2013).

In addition to noise level, the frequency and regularity of the noise also affect species sensitivity. That is, different types of noise sources will produce different effects on different species. Noise from aircraft overflights may not produce the same response from a wildlife species as noise from a land-based noise source such as a vehicle, chainsaw, or gun shot. Wildlife species often do not react only to a noise source but more importantly to the visual component associated with that noise source. Nesting birds will react to a noise source by tilting their head, becoming alert, etc. but often do not leave the nest or perch until there is a visual connection with the noise source. For example, birds may not react to just the sound of a chainsaw, but when that sound is coupled with a human walking near the bird, the bird will flush. This is also shown in reactions by various species to aircraft overflights (airplanes and helicopters). An overflight with just a sound component does not elicit a strong response, but if an animal hears and then sees the aircraft, the bird will more likely flush and move away (Manci *et al.* 1988; USFWS 1992; Krausman *et al.* 1993; Bowles 1995). In other words, human intrusions near roost sites, nests, foraging areas, etc. (e.g., timber harvesting, hiking, hunting) are readily detectable and substantial (USFS 1992).

Species that are commonly hunted often demonstrate behavioral (e.g., flushing, startle response) or physiological responses (e.g., increased heart rates, increased respiration rates) to gunshot sounds (Larkin *et al.* 1996). Knight *et al.* (1987) found that American crows nesting in urban areas were less wary of people than American crows nesting in rural habitat and attributed the difference to the hunting of rural crows. Barron *et al.* (2012) found that American crows avoided areas with live-fire exercises in a similar fashion and suggested that species hunted by humans will be more adversely affected by human activity, including military training (e.g., live-fire training) than species that are not hunted.

As stated by Morton and Wiles (2002), "Poaching is a particularly insidious activity because not only does it impact fruit bats through mortality, it reinforces behavioral avoidance of humans. Consequently, roosting or foraging fruit bats that might not otherwise be disturbed by some human activities … may become unduly sensitized to them because of illegal hunting." Based on observations on Guam and Rota, fruit bats have abandoned areas where hunting has occurred and did not return even though no further hunting or gunshots occurred within the area for months after (Janeke 2006; AAFB 2008b; USFWS 2009a; Mildenstein and Mills 2013). In addition, anecdotal evidence from numerous individuals who have conducted fruit bat research on Guam and the CNMI for many years indicate that fruit bats do avoid areas that have been previously subjected to hunting and also areas that experience live-fire activities (G. Wiles, Washington Department of Fish and Wildlife, personal communication, 2014; T. Mildenstein, University of Montana, personal communication, 2014; D. Janeke, HDR, Inc., personal communication, 2014; N. Johnson, Marianas Conservation Unlimited, personal communication, 2014). For example, during fruit bat monitoring at AAFB near the CATM range as part of a larger study monitoring the effects of aircraft overflights on fruit bats and crows (JRM *et al.* 2012b), N. Johnson observed flying fruit bats avoid the CATM range by 300-400 m when live-fire operations were being conducted (N. Johnson, Marianas Conservation Unlimited, personal communication, 2014).

However, a species can also habituate to human-generated noise when the noise is not followed by an adverse impact. While fruit bats may avoid an area subjected to hunting and the associated gun shots, fruit bats, like most wildlife species, will also learn that if a disturbance or sound does not produce an adverse effect (e.g., mortality), then they can habituate to that disturbance or sound and will not show an adverse reaction (e.g., flying away, avoiding the area) (Boyle and Samson 1985; Francis and Barber 2013).

Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) may

influence reproductive success and confound the ability to identify the ultimate factor in limiting productivity of a certain species, area, or region (Smith *et al.* 1988).

Based on identified recovery habitat for the Mariana fruit bat (USFWS 2010b), noise levels of 60 dB ADNL and greater would overlie 1,507 acres (610 ha) of recovery habitat in the vicinity of Alternative 4 (Table 5.4.8-5).

Table 5.4.8-5. Noise Levels overlying Mariana Fruit Bat Recovery Habitat (acres [ha]) with Implementation of LFTRC Alternative 4

60-64 dB ADNL	*65-74 dB ADNL*	*75-85+ dB ADNL*	*Total*
734.4 (297.2)	614.3 (248.6)	158.0 (63.9)	**1,506.7** **(609.7)**

Given the ongoing poaching of fruit bats on Guam, it is likely that those fruit bats that currently occur on Guam will avoid areas of live-fire training as they may have experienced a poaching event. While there is the potential for eventual habituation by fruit bats to LFTRC live-fire activities, fruit bats are expected to initially avoid areas of live-fire training activities. Therefore, fruit bats may temporarily avoid approximately 1,507 acres (610 ha) of recovery habitat due to proposed live-fire range operations. However, proposed live-fire operations at the LFTRC are not continuous and would occur between 7:00 a.m. and 7:00 p.m. for 39 weeks per year, and night operations (estimated to occur 2 nights per week over 39 weeks per year) would occur between 7:00 p.m. and 10:00 p.m. or 6:00 a.m. and 7:00 a.m. In addition, live-fire operations would not physically impact recovery habitat. This temporary avoidance of recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, and it would not substantially reduce the total number of fruit bats that the island can support.

With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, applicable elements of the SIP, and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of Alternative 4 is considered unlikely. Therefore, there would be less than significant impacts to the Mariana fruit bat with implementation of proposed operational activities associated with Alternative 4.

MARIANA CROW, GUAM RAIL, AND GUAM MICRONESIAN KINGFISHER. These species are extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of these species is reasonably certain to occur and the species are likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of these species, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow, rail, and kingfisher are successfully re-introduced and then have the potential to be exposed to operational activities under Alternative 4, there would be no impact to these species. If the species are reintroduced and exposed to LFTRC operational activities under Alternative 4, they may be disturbed.

MARIANA SWIFTLET. Based on surveys conducted for this SEIS, swiftlets were observed within the vicinity of the proposed ranges or within the modeled noise contours associated with the proposed ranges under Alternative 4 (see Figure 5.4.8-2b). Swiftlets would continue to forage within the extensive foraging habitat to the north, west, and east of the proposed range areas, and areas in the vicinity of the nest/roost caves on NAVMAG and the drainages of the Mahlac, Maagas, and Talofofo rivers (see Figures

5.2.8-1 and 5.2.8-3). The proposed range operations would not impact regional insect populations that are the prey base for the swiftlet. In addition, swiftlets are generally more actively foraging in the early morning and late evenings before and after proposed range operations. As swiftlets do not have a history of being hunted, they would not have the same aversion to gunfire that Mariana fruit bats have, and therefore may not avoid areas of live-fire range operations. Proposed range operations and associated noise would not impact the swiftlet nesting/roosting caves approximately 1 mile (1.6 km) to the east of the proposed range in the northern portion of the Alternative 4 action area, and the nest caves would not be within the modeled noise contours associated with the proposed ranges. Therefore, given the extensive remaining foraging habitat within the surrounding areas that would still be available for foraging, and that swiftlets would still forage in the mornings and evenings before and after range operations, there would be less than significant impacts to the Mariana swiftlet due to proposed range operations under Alternative 4.

MARIANA COMMON MOORHEN. The modeled 55 dB ADNL noise contour overlies a pond to the east of the proposed range in the northern portion of the Alternative 4 action area (see Figure 5.4.8-2a). However, the low modeled noise level that may occur within the vicinity of the pond (i.e., 55 dB ADNL is approximately equal to ambient noise levels; see Section 3.4, Noise), there would be less than significant impacts to Mariana common moorhens with implementation of the proposed range operations under Alternative 4.

For the southern ranges under Alternative 4, the modeled 55 dB ADNL noise contour overlies the southern portion of Fena Valley Reservoir. However, moorhens primarily use the northern portion of the reservoir, near the spillway, for nesting, feeding and resting (Brooke and Grimm 2008; Brindock 2012). Given the low modeled noise level that may occur within the southern portion of the reservoir (i.e., 55 dB ADNL is approximately equal to ambient noise levels; see Section 3.4, Noise), and that moorhens predominantly use the northern portion of the reservoir that would be outside the 55-dB contour, there would be less than significant impacts to Mariana common moorhens with implementation of the proposed range operations under Alternative 4.

MARIANA EIGHT-SPOT BUTTERFLY. Some species of tropical butterflies have well-developed ears on their wings and can detect sounds at the same frequencies that humans can hear. It is hypothesized that the butterflies are listening to the flight sounds or foraging calls of predatory birds (Lane *et al.* 2008; Yack 2012). Given the low numbers of forest birds currently on Guam due to the brown treesnake, masking of the flight sounds or foraging calls of predatory birds due to noise from proposed construction activities would not make eight-spot butterflies more susceptible to predation.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by increasing erosion, allowing for the establishment of non-native species, and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. Native plants and their habitats on Guam are adapted to a humid, tropical climate and are not adapted to a fire driven ecosystem (USFWS 2008a).

As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's Wildland Fire Management Plan (Nelson 2008) (see Section 2.8). It would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions), and location and management of firebreaks, fire-fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). With implementation of the

Range Fire Management Plan, which establishes management and fire suppression and emergency response procedures, potential impacts from range-related wildfires would be less than significant. The USFWS concluded in their BO for the 2010 Final EIS that they anticipated that no additional vegetation would be lost due to wildfires igniting as a result of proposed training operations (USFWS 2010a). Therefore, as operation of the range would not remove additional vegetation (e.g., host plants), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed range operations under Alternative 4.

SERIANTHES TREE. *Serianthes* does not occur within the Alternative 4 action area. Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see *Vegetation* above, and Section 2.8), potential impacts from range-related wildfires on *Serianthes* would be less than significant. Therefore, there would be less than significant impacts to *Serianthes* or recovery habitat due to proposed range operations under Alternative 4.

TABERNAEMONTANA ROTENSIS AND *CYCAS MICRONESICA.* Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see *Vegetation* above, and Section 2.8), potential impacts from range-related wildfires on *T. rotensis* and *C. micronesica* would be less than significant. There would be no other impacts to *T. rotensis* and *C. micronesica* with implementation of the proposed range operations associated with Alternative 4.

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PACIFIC SLENDER-TOED GECKO. Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see *Vegetation* above, and Section 2.6), potential impacts from range-related wildfires on the Pacific slender-toed gecko would be less than significant. There would be no other impacts to the Pacific slender-toed gecko with implementation of the proposed range operations associated with Alternative 4.

MERRILLIODENDRON MEGACARPUM. Although fire potential could increase due to proposed live-fire range operations, with implementation of the proposed Range Fire Management Plan and procedures (see *Vegetation* above, and Section 2.8), potential impacts from range-related wildfires on *M. megacarpum* would be less than significant. There would be no other impacts to *M. megacarpum* with implementation of the proposed range operations associated with Alternative 4.

5.4.9 Marine Biological Resources

5.4.9.1 Affected Environment

As there are no in-water construction, dredging, or training activities and/or land-based construction activities under the proposed NAVMAG (L-Shaped) alternative that would affect the marine environment, the affected environment for marine biological resources under this alternative would remain unchanged.

5.4.9.2 Environmental Consequences

There are no in-water construction, dredging, or training activities and/or land-based construction activities proposed under the NAVMAG (L-Shaped) alternative that would directly affect the marine environment. Therefore, no direct or indirect impacts are expected.

Scoping comments noted concern regarding the possibility that contamination could migrate from the ranges through stormwater runoff. However, as discussed in Section 5.4.2, Water Resources, there would be no impacts to nearshore waters through implementation of surface water protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs during construction and implementation of LID features in accordance with the DoD UFC LID [UFC 3-210-10] and Section 438 of the EISA, range maintenance BMPs, and pollution prevention plans during operations).

5.4.10 Cultural Resources

5.4.10.1 Affected Environment

The following discussion summarizes previous cultural resources studies, known historic properties, and other cultural resources within the PDIA and PIIA associated with Alternative 4. The Alternative 4 area, also known as NAVMAG (L-Shaped), is situated on the south-central portion of Guam and includes land within the NAVMAG and lands to the west and to the southeast of the NAVMAG. As early as December 1944, miles of roads and magazines were constructed at the NAVMAG and the area was commissioned on February 22, 1945 (Mason Architects and Weitze Research 2009). During a limited expansion in the Korean conflict of the early 1950s, most of the present main administration buildings and many of the magazines in what was known as the Naval Magazine or NAVMAG were designed and built as part of the permanent base development program for Guam.

The affected environment for cultural resources associated with Alternative 4 is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 12: Cultural Resources, Section 12.1.5.1: Naval Munitions Site, pages 12-33 to 12-37). This description of the affected environment is updated here with new information from recent archaeological and architectural investigations conducted for this SEIS and other projects. To determine whether site information is from previous investigations (such as the 2010 Final EIS or other cultural resource studies) or prepared during in-fill studies conducted for this SEIS, refer to dates in the reference column in each table for the archaeological sites. Certain information about built properties (such as date and function) was derived from iNFADS.

Portions of the Alternative 4 PDIA and PIIA were surveyed for the presence of cultural resources for the original proposed action (2010 Final EIS). Those and other previous investigations in the area included archaeological surveys (Tuggle 1993; Hunter-Anderson 1994**;** Craib and Nees 1998; Henry *et al.* 1999; Allen *et al.* 2002; Hunter-Anderson and Moore 2002; Dixon *et al.* 2004; and Welch 2010), architectural inventories (Mason Architects and Weitze Research 2010; Welch 2010), and TCP studies (Griffin *et al.* 2010). Additional investigations conducted for this SEIS included intensive cultural resource inventories conducted for PDIA and reconnaissance inventories in PIIA for this SEIS (Dixon *et al.* 2015a, 2015b). Note that due to changes in the alternative as a result of the SEIS planning process, 71.8 acres (29 ha) in the PDIA and 182.53 acres (73.87 ha) in the PIIA were added for Alternative 4 after the surveys were conducted. These 254.3 acres (102.87 ha) were examined through historic materials, aerials, and a comparison with adjacent areas to assess impacts to cultural resources. Collectively, these investigations provide the comprehensive inventory of cultural resources for Alternative 4.

As described in Section 5.1.10.1, the HG Range would be located at Andersen South under all of the LFTRC alternatives. This area was previously surveyed at an intensive level (Welch 2010; Dixon *et al.* 2011a).

During October through December 2014, the DON consulted with the parties to the 2011 PA and the public on the Draft TRRA. Consistent with Stipulation V.C of the 2011 PA, the TRRA provided planning level information on potential direct and indirect effects to historic properties within areas that may be selected in the Navy's ROD for the live-fire training range complex. The Draft TRRA included information on the locations, orientations, and designs of each proposed LFTRC location. In addition to receipt of written comments, DON cultural resources professionals conducted three consultation sessions with the parties to the PA to discuss the analysis. The DON will take all comments into account in preparing the Final TRRA, which is planned for publication shortly after this Final SEIS. Comments and considerations developed during the Draft TRRA consultation process have been incorporated in this Final SEIS and informed the Draft RMP, as required by Stipulation V.C.4 of the 2011 PA.

Cultural Resources in the Alternative 4 PDIA

Alternative 4 would involve the construction of individual ranges, support buildings, munitions magazine relocation area, and access roads (see Figure 2.5-5). This construction area comprises the PDIA. Table 5.4.10-1 lists 13 known archaeological sites located within the Alternative 4 PDIA within the NAVMAG. Eleven sites, including sites with *latte* sets, rockshelters, WWII military sites, and artifact scatters, are eligible for listing in the NRHP. Two sites, consisting of a WWII-era American military concrete slab and a small Latte Period artifact scatter, are not considered eligible for listing in the NRHP. No historic properties have been identified in the PDIA of the proposed HG Range at Andersen South.

Table 5.4.10-1. Archaeological Sites within the Alternative 4 PDIA

GHPI Number[1]	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-02-0145A	29*	West Bonya *Latte* Complex	Pre-Contact/Latte	Craib and Yoklavich 1997	Yes	D
66-02-0145B	30*	East Bonya *Latte* Complex	Pre-Contact/Latte	Craib and Yoklavich 1997	Yes	D
66-02-1659	496*	Trenches and foxholes[2]	WWII Japanese Military Occupation	Allen *et al.* 2002	Yes	D
66-02-1660	497*	*Latte* set and rockshelter complex[2]	Pre-Contact/Latte	Allen *et al.* 2002	Yes	D
	31/555*	Foxhole, cave[2]	WWII Japanese Military Occupation	Henry *et al.* 1999	Yes	D
	32/556*	Rockshelter[2]	Pre-Contact/Latte	Henry *et al.* 1999	Yes	D
	587*	*Latte* cluster	Pre-Contact/Latte	Henry *et al.* 1999	Yes	D
66-08-2628	T-TA-002	*Latte* set partial[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2629	T-TA-004	*Latte* set	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2630	T-TA-005	Artifact scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D
66-08-2632	T-TA-031	Artifact scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	Yes	D

Table 5.4.10-1. Archaeological Sites within the Alternative 4 PDIA

GHPI Number[1]	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-2759	T-TA-047	Artifact scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2015a	No	NA
	OA-8/808*	Concrete slab	Post-WWII/Second American Territorial	Hunter-Anderson and Moore 2002	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion D = eligible for potential to yield information important in prehistory or history.

Notes: [1] Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys and submitted to SHPO.
[2] Sites are in both the PDIA and the PIIA.
*Welch et al. 2009.
** Revised to match Guam GHPI forms dated May 28, 2014.
***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated August 22, 2013 [RC2013-0853]).

Table 5.4.10-2 lists the 11 known structures and buildings located within the Alternative 4 PDIA. All of these structures and buildings are covered under the 2006 *Program Comment for World War II and Cold War Era Ammunitions Storage Facilities* (ACHP 2006).

Table 5.4.10-2. Summary of Architectural Properties Located within the Alternative 4 PDIA

Building/Structure Type	*Location*	*Number of Buildings/Structures of this Type in Potential Impact Area*	*Date of Construction*	*NRHP Eligible?*
ARMCO Magazines	NAVMAG	2	1944 to 1945	Covered under Program Comment
Magazine Fuse Detonator (Facility No. 454NM)	NAVMAG	1	1952	Covered under Program Comment
Revetments	NAVMAG	7	1944 to 1945	Covered under Program Comment
Quonset Hut Style Magazine	NAVMAG	1	Post-1946	Covered under Program Comment

Note: Information on type, number, and date of construction from iNFADS.

No TCPs have been identified in the PDIA for Alternative 4.

Cultural Resources in the Alternative 4 PIIA

The PIIA comprises SDZs for the LFTRC and HG ranges and associated areas potentially affected by increases in noise. It includes no locations of potential direct impact due to construction. Table 5.4.10-3 summarizes the 248 known archaeological sites located within the Alternative 4 PIIA. There are 219 NRHP-eligible sites, including artifact scatters, *latte* sites, rockshelters, and historic military features. Twenty-seven sites have not been evaluated for listing in the NRHP and two sites are considered not eligible for listing in the NRHP. Should this alternative be selected, final assessments would be determined consistent with the procedures outlined in the 2011 PA.

Table 5.4.10-3. Summary of Archaeological Sites and Potential TCPs Known to be Located within the Alternative 4 PIIA

Site Type	*Period*	*Number of Sites of this Type in Impact Area*	*NRHP Eligible?*	*NRHP Criteria*
Pre-Contact Artifact Scatters	Pre-Contact	33	Yes	D
Pre-Contact Artifact Scatters	Pre-Contact	16	Not Evaluated	NA
Pre-Contact Artifact Scatters	Pre-Contact	1	No	NA
Mixed Component Artifact Scatters	Mixed Component	4	Yes	D
Chiseled Steps	Pre-Contact	1	Yes	D
Mortars	Pre-Contact/Latte	1	Yes	D
Historic Artifact Scatters	Post WWII/Second American Territorial	7	Yes	D
Mixed Component Artifact Scatters	Latte/Spanish Missionization Period/Chamorro Spanish Wars, WWII Japanese Military Occupation	1	Not Evaluated	NA
Historic Artifacts Scatters	WWII Japanese Military Occupation	1	Yes	D
Historic Artifacts Scatters	WWII Japanese Military Occupation	1	Not Evaluated	NA
Latte Sites	Pre-Contact/Latte	94	Yes	D
Latte Sites	Pre-Contact/Latte	9	Not Evaluated	NA
Latte Sites	Pre-Contact/Spanish Missionization Period/Chamorro Spanish Wars	7	Yes	D
Mixed Component *Latte* Site	Pre-Contact/Latte/WWII Japanese Military Occupation/Post-WWII/Second American Territorial	6	Yes	D
Rockshelters/Caves	Pre-Contact/Latte	44	Yes	D
Rockshelters/Caves	Mixed Component	10	Yes	D
Rockshelters/Caves	WWII Japanese Military Occupation/Post-WWII/Second American Territorial	3	Yes	D
Japanese Defenses	WWII Japanese Military Occupation	4	Yes	D
Historic Features	Post-WWII/Second American Territorial	1	Yes	D
Historic Features	Post-WWII/Second American Territorial	1	No	NA
Cave with pictographs	Pre-Contact/Latte	1	Yes	C, D
Pre-Contact Features	Pre-Contact/Latte	2	Yes	D
Potential TCP	Pre-Contact/Latte, Post WWII/Second American Territorial, Organic Act/Home Rule/Economic Development	6	Yes^	A

Legend: NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion D = eligible for potential to yield information important in prehistory or history

Note: ** Revised to match Guam GHPI forms dated May 28, 2014.

^ Eligibility of this site has not been fully determined. However, for the purpose of this analysis, it is assumed eligible.

There are 56 architectural properties, constructed between 1944 and 2007, located within the PIIA for Alternative 4 (Table 5.4.10-4). These buildings and structures are primarily associated with WWII and Cold War-era ammunition storage and support facilities. Forty-one of the structures are ammunition storage facilities covered under the *Program Comment for World War II and Cold War Era Ammunition Storage Facilities* (ACHP 2006; see Chapter 3.10.3 for more information on the Program Comment). Eleven buildings and structures greater than 50 years in age have not been evaluated. Four structures are less than 50 years old and do not meet the exceptional significance threshold required under NRHP Criteria Consideration G. Should this alternative be selected, final assessments would be determined consistent with the procedures outlined in the 2011 PA.

Table 5.4.10-4. Summary of Architectural Properties Located within the Alternative 4 PIIA

Building/Structure Type	*Location*	*Number of Buildings/Structures of this Type in Potential Impact Area*	*Date of Construction*	*NRHP Eligible?*
ARMCO Magazines	NAVMAG	4	1944 to 1945	Covered under Program Comment
Explosive Truck Holding Yard (Facility Nos. 629-639)/Map No. 34*	NAVMAG	11	1944 to 1945	Not Evaluated
Inert Storehouse (Facility No. 309NM & 310NM)/Map No. 37*	NAVMAG	2	1949	Covered under Program Comment
Open Storage Areas/ Revetments Complex (Facility Nos. 612, 614, 616, 617, 618, 619, 620, 621,622, 623, 624)/Map No. 43*	NAVMAG	11	1944 to 1945	Covered under Program Comment
Revetments	NAVMAG	21	1944 to 1945	Covered under Program Comment
High Explosive Magazines (Facility Nos. 435-437)/Map No. 1053*	NAVMAG	3	1952	Covered under Program Comment
Ammunition Rework Overhaul (Facility No. 779NM)	NAVMAG	1	1965	No
EOD Crew Blast Shelter (Facility No. 862NM)	NAVMAG	1	1976	No
Utility Building (Facility No. 840NM)	NAVMAG	1	1969	No
Close Quarter Battle Breach Training (Facility No. 640NM)	NAVMAG	1	1997	No

Six potential TCPs have been identified in the PIIA for this alternative. They include Bona Springs, Alifan Peak, Almagosa Springs, Dobo Springs, Almagosa Mountain, and a high density area of *latte* sites (Griffin *et al.* 2010).

5.4.10.2 Environmental Consequences

Construction

Construction activities of Alternative 4 have the potential to affect historic properties and impact culturally important natural resources. Final determinations of effect would follow the procedures outlined in the 2011 PA. Following is a discussion of potential direct and indirect effects to historic properties and impacts to culturally important natural resources.

Construction of the ranges, support facilities, relocated magazine, and utilities would occur in NAVMAG and east of NAVMAG (see Figure 2.5-5). Given the substantial development anticipated in the PDIA, it is assumed for purposes of this analysis that 100% of the area would be disturbed. Nevertheless, design alternatives to avoid and minimize adverse effects would be considered, consistent with procedures in the 2011 PA. No construction would occur in the PIIA. Excavation and soil removal associated with the construction of Alternative 4 could adversely directly affect 11 known historic properties, including Pre-Contact artifact scatters, sites containing *latte* components, and WWII military sites (see Table 5.4.10-1). Seven of the historic properties are located within both the PDIA and the PIIA. Direct impacts to these sites would only occur to the portion within the PDIA. Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the 71.8 acres (29 ha) of unsurveyed areas within the PDIA. If this alternative were selected, final assessments would be determined consistent with the procedures in the 2011 PA.

Construction associated with Alternative 4 may also require the demolition of architectural properties. All of the buildings and structures are covered under the *Program Comment for World War II and Cold War Era (1939-1974) Ammunition Storage Facilities* (ACHP 2006), which resolves NHPA Section 106 requirements for their demolition.

Construction activities associated with Alternative 4 have the potential to directly impact culturally important natural resources. The project would require the removal of limestone forest and savanna vegetation where culturally important natural resources may be located. The 2011 PA contains measures for coordinating with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners and traditional artisans regarding identification and disposition of these important resources prior to construction (see 2010 Final EIS, Volume 2: page 2-10; Volume 9: Appendix G, Chapter 4).

No historic properties or culturally important natural resources are anticipated in conjunction with utility upgrades that would be associated with Alternative 4 The modification or replacement of existing overhead electrical utilities under Alternative 4 would not affect any known cultural resources. There are no historic properties located in the PDIA or PIIA for the proposed HG Range at Andersen South. Therefore, no adverse effects to historic properties are anticipated due to construction of the HG Range.

Operation

Operations associated with Alternative 4 could cause indirect adverse effects to historic properties as discussed below. Final determinations of effect would follow the procedures in the 2011 PA. Following is a discussion of potential adverse effects of operations associated with Alternative 4.

The potential for direct effects within the SDZ would be limited to the risk of strikes from stray rounds during Alternative 4 operations. The risk of such effects occurring is extremely low. The range would be designed to contain live fire inside the range itself to minimize the probability of rounds landing in the SDZ. Additionally, if a stray round were to escape the range, the chance of it hitting a historic property is

remote, given the size of the SDZ and dispersal of historic properties. For these reasons, the potential for direct adverse effects as a result of range operations is *de minimis*.

Indirect adverse effects to NRHP-eligible archaeological sites from the operation of Alternative 4 could result from changes affecting site integrity. For many types of archaeological sites (e.g., ceramic scatters, rock alignments), auditory impacts associated with live-fire operations would not affect characteristics that qualify them for the NRHP. An increase in noise associated with live-fire operations may adversely affect historic properties for which solitude, quiet, or contemplation contribute to or define their significance, such as TCPs. Under Alternative 4, small arms live-fire noise would be audible near 40 NRHP-eligible sites, 20 unevaluated sites, one not eligible site and two potential TCPs (Bona Springs and Alifan peak) that are located within the expanded noise contours (Table 5.4.10-5). Average noise levels during range operations are projected to increase from current levels of approximately 45 dB to between 65 dB and 85 dB ADNL (see Section 5.4.4, Noise). Thirty-two of the sites are Pre-Contact artifact scatters or features, rockshelters/caves, and historic military features, while 29 sites contain *latte* components. Auditory impacts associated with range operations would not adversely affect the integrity of the NRHP-eligible artifact scatters, historic military features, or other historic remains. Changes to the setting of the 29 sites (24 eligible for listing in the NRHP and 5 unevaluated) with *latte* components could be adverse. There may also be an effect to two potential TCPs. Final determinations of effect would follow the procedures in the 2011 PA.

Table 5.4.10-5. Summary of Archaeological Sites and Potential TCPs Potentially Affected by Noise

Site Type	*Period*	*Number of Sites of this Type in Impact Area*	*NRHP Eligible?*	*NRHP Criteria*
Pre-Contact Artifact Scatters	Pre-Contact/Latte	3	Yes	D
Pre-Contact Artifact Scatters	Pre-Contact/Latte	15	Not Evaluated	NA
Historic Artifact Scatters	Post-WWII/Second American Territorial	1	Yes	D
Latte Sites	Pre-Contact/Latte	24	Yes	D
Latte Sites	Pre-Contact/Latte	5	Not Evaluated	NA
Rockshelters/Caves	Pre-Contact/Latte	2	Yes	D
Rockshelters/Caves	WWII Japanese Military Occupation/Post-WWII/Second American Territorial	5	Yes	D
Japanese Defenses	WWII Japanese Military Occupation	2	Yes	D
Historic Features	Post-WWII/Second American Territorial	2	Yes	D
Historic Features	Post-WWII/Second American Territorial	1	No	NA
Pre-Contact Features	Pre-Contact/Latte	1	Yes	D
Potential TCP	Pre-Contact/Latte, Post WWII/Second American Territorial, Organic Act/Home Rule/Economic Development	2	Yes^	A

Notes: ^ Eligibility of this site has not been fully determined. However, for the purpose of this analysis, it is assumed eligible.

Similar to historic military sites, noise associated with range operations is not likely to adversely affect the integrity of ammunition storage support facilities. Therefore, no indirect effects are anticipated to buildings and structures from changes in noise levels. No indirect adverse effects from visual intrusions associated with Alternative 3 are anticipated, as the ranges are within an existing military operations area and the action would not involve a change in visual setting.

Access to all sites within the PIIA would be restricted during range operations; however, most of these sites are located within areas that currently have limited access due to operations at NAVMAG or their remote locations. Members of the public have requested to visit Almagosa Springs and other areas of NAVMAG in the past and there is a process to access certain areas. Therefore, indirect impacts could result from additional restriction on access to four potential TCPs (Almagosa Springs, Dobo Springs, Almagosa Mountain, and a high density area of *latte* sites). The 2011 PA requires development of plans for regular public access to historic properties for DoD-controlled lands on Guam, subject to considerations including but not limited to public interest, public safety concerns and protocols, installation security, and emergency situations.

Summary of Impacts and Potential Mitigation Measures

Implementation of Alternative 4 could cause direct, adverse effects to 11 known NRHP-eligible archaeological sites. Potential indirect adverse effects could occur to 24 NRHP-eligible archaeological sites with *latte* components. Undetermined effects could occur to five unevaluated archaeological sites with *latte* components and two potential TCPs. Four potential TCPs could also be indirectly impacted by reduced accessibility. In addition, culturally important natural resources could be directly impacted due to removal of limestone forest and savanna vegetation. If this alternative were selected, final assessments would be determined consistent with the procedures identified in the 2011 PA.

Adverse effects that could occur from construction and operation under this alternative would be less than under than under Alternative 5 (the greatest effects from construction would occur under Alternative 5, and the greatest effects from operation would occur under Alternative 5). Refer to Section 5.7, Table 5.7-1 for a comparison of cultural resources impacts and potential mitigation measures for each LFTRC alternative.

The 2011 PA, as discussed in Section 3.1.2, establishes a program alternative for complying with NHPA Section 106 requirements. Broadly, the 2011 PA includes processes to share information, consider views of the public, and develop mitigation measures when historic properties are adversely affected. The 2011 PA provides measures for mitigating adverse effects to NRHP-eligible or listed archaeological sites, consulting on new projects and initiating additional identification efforts, and resolving impacts due to loss of access to areas of cultural importance or culturally important natural resources.

More specifically, the 2011 PA established a process for the review and analysis of potential effects to historic properties and other cultural resources for all alternative LFTRC locations. During October through December 2014, the DON consulted with the parties to the PA and the public on the TRRA, which provided information about cultural resources potentially affected by the LFTRC alternatives carried forward in the SEIS, consistent with PA Stipulation V.C. The TRRA provides information on potential adverse effects resulting from the construction and operation of the LFTRC alternative to support consultation with the PA parties and the public. The DON will take all comments into account before reaching a final decision. For any alternative selected in the ROD, the 2011 PA stipulates that a RMP will be prepared to address effects from the construction and operation of the ranges. The RMP, developed in consultation with the consulting parties, will stipulate measures to avoid, minimize, and mitigate adverse effects to historic properties.

To the degree possible, impacts to historic properties and resources of cultural importance would be avoided or minimized during the planning process. Consultation under the 2011 PA would address potential adverse effects and alternatives to avoid adverse effects. Refer to Section 3.10 for more information on definitions and procedures. If avoidance is not possible, Table 5.4.10-6 presents potential mitigation measures to resolve adverse effects to historic properties and reduce impacts to cultural resources resulting from the implementation of Alternative 4. With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that direct and indirect, short-and long-term impacts would be reduced to a level below significance.

Table 5.4.10-6. Potential Mitigation Measures for Alternative 4 for Adverse Effects (NHPA) and Impacts to Other Cultural Resources (NEPA)

NHPA Effects	***Mitigation***
Potential direct adverse effects to 11 historic properties NRHP-eligible archaeological sites from construction and potential indirect adverse effects to 24 historic properties from changes in use that degrade site integrity.	Development and implementation of the RMP to identify specific measures to avoid, minimize, and mitigate direct and indirect adverse effects to historic properties.
Potential indirect effects to four potential TCPs from restricted access.	Development of an RMP would include consideration of options for access that considers public interest, public safety, and installation security for access to these possible culturally sensitive locations.
Undetermined effects to five unevaluated sites and two potential TCPs.	If this alternative is selected in the ROD, unevaluated properties that may be affected would be evaluated consistent with the 2011 PA. If determined eligible for listing in the NRHP, appropriate mitigation measures would be developed to resolve any adverse effects.
NEPA Impacts	***Mitigation***
Potential impacts to culturally important natural resources.	Through the 2011 PA process, coordinate with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans to provide an opportunity to collect these resources consistent with installation security instructions and safety guidelines.

5.4.11 Visual Resources

5.4.11.1 Affected Environment

The 2010 Final EIS describes the proposed activities at NAVMAG (Volume 2, Chapter 2: Proposed Action and Alternatives, Section 2.3.1: Requirements, page 2-49). Although Alternative 4 differs from the 2010 Final EIS activities at NAVMAG, the potentially affected visual environment and the visual resources themselves would remain the same. A list and description of visual resources at the NAVMAG is provided in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.1.4.1: Naval Munitions Site, pages 13-54 to 13-57). See Section 4.3.11 for a summary of the visual resources at NAVMAG.

5.4.11.2 Environmental Consequences

Similar to Alternative 3, this alternative would involve construction of a live-fire range and a range maintenance building 3 miles (5 km) north of Mount Lamlam and 4 miles (6 km) north of the publicly accessible Jumullong Manglo Overlook. The Alternative 4 facilities may be visible from the public areas as well as from the trails leading up to them. Unlike Alternative 3, the remaining live-fire range facilities

would be located east of NAVMAG, on land that would be acquired. These facilities would not be visible from the aforementioned publicly accessible areas.

Construction

During construction, activities and equipment would temporarily cause view obstructions where recognized views currently exist. The visual impacts during the construction phase would be temporary and less than significant.

Operation

The Alternative 4 facilities may be visible from Jumullong Manglo Overlook, as well as from the trails leading up to the Overlook near the top of Mount Lamlam, a National Natural Landmark. The elevations of both Mount Lamlam (the highest point on Guam) and Jumullong Manglo Overlook could result in the ability to see portions of the 1 mile (2 km) of new roadways, areas of removed vegetation and cut/fill features, and earthen berms, as well as some of the proposed structures such as some of the 66 relocated ordnance magazines.

The impact on visual resources would be significant. However, because fewer facilities are proposed at the northern end of NAVMAG, this alternative's impact on visual resources, although still significant, would be less than that of Alternative 3. Potential mitigation measures to reduce this impact to less than significant are the following:

- To maintain the existing visual appearance, land clearing and grading should be minimized to the extent possible on lands proposed for range uses.
- Minimize impact by using native flora to create a natural-appearing "screen" around the cleared range areas, outside of the firebreaks/perimeter roads.

Alternative 4 would have a greater impact to visual resources than Alternatives 1, 2, and 5 because of the potential long-term ability to see the new structures from public viewing areas. Alternative 4 would have a lesser impact than Alternative 3, because fewer of the proposed roadway and ordnance magazines would be visible.

5.4.12 Ground Transportation

5.4.12.1 Affected Environment

The affected environment for ground transportation resources associated with the NAVMAG (L-Shaped) LFTRC alternative includes transportation facilities internal to the site (range roadways and intersections). This section discusses existing conditions and assesses how Alternative 4 would potentially affect transportation conditions for roadways and intersections internal to the site. Impacts to off-base (external) roadways and intersections are summarized in Section 6.1 of this SEIS.

5.4.12.2 Environmental Consequences

Construction

Potential construction impacts to ground transportation under Alternative 4 would be the same as those described in Section 4.2.12.2 for Alternative A. Potential direct and indirect impacts to ground transportation resources from construction would be minimized with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, there would be less than significant short-term impacts to on-base (internal) roadways.

Operation

Proposed access to Alternative 4 would be from the existing NAVMAG Main Gate located on Route 5. The proposed Alternative 4 would have ranges and facilities in two locations. This would reduce the efficiency in both range maintenance and management, and would result in additional travel between the two areas. The MPMG and Range Maintenance Building would be in the same location as Alternative 3. All other ranges would be located on non-federal property east of the NAVMAG site. Existing roadways would be used wherever possible. However, this alternative requires the construction of an access road to allow all-weather operations. A total of 3.0 miles (5.0 km) of internal roadways would be required to support LFTRC operations.

Traffic generated by Marine Corps training activity is discussed in Section 5.2.12.2 and summarized in Tables 5.1.12-1 and 5.1.12-2. This traffic represents the maximum potential adverse effect for traffic.

Potential operational impacts for Alternative 4 would be the same as those described in Section 5.1.12.2 for Alternative 1; there would be no direct, long-term significant impacts to internal (range) roadway segments or intersections.

5.4.13 Marine Transportation

5.4.13.1 Affected Environment

The NAVMAG (L-Shaped) LFTRC alternative and SDZ do not extend over open waters used by vessels. Thus, there is no marine transportation in the proposed area.

5.4.13.2 Environmental Consequences

Implementation of Alternative 4 would not impact open waters used by vessels. Therefore, it is expected that there would be no impact to marine transportation due to the construction and operation of Alternative 4.

5.4.14 Utilities

5.4.14.1 Affected Environment

Existing utilities in the vicinity of the proposed HG Range are the same as discussed in Section 5.1.14.1 for Alternative 1.

Alternative 4 is essentially a combination of Alternatives 2 and 3, with the LFTRC ranges split between the existing NAVMAG area and private lands to the east of the current NAVMAG area.

Electrical Power

The electrical utility that would be near the proposed NAVMAG (L-Shaped) LFTRC Alternative 4 site consists of an existing local GPA power distribution system buried underground in the existing Dandan Road (at the beginning of the proposed new access road), and the DON power distribution system at the NAVMAG complex. The GPA system includes buried power lines and manholes along Dandan Road. This distribution system primarily serves the Dandan communication installation and the Layon Landfill. The DoD distribution system includes electrical lines and transformers serving the existing NAVMAG area, including the water treatment plant and Fena Reservoir.

Potable Water

The potable water system near the proposed Alternative 4 site includes a local GWA water distribution system buried underground in the existing Dandan Road as described in Section 5.2.14 (Alternative 2)

and a local DoD water distribution system on the existing NAVMAG property as described in Section 5.3.14 (Alternative 3).

Wastewater

The wastewater utility near Alternative 4 consists of an existing GWA underground wastewater collection system in the existing Dandan Road (at the beginning of the proposed new access road) and DoD wastewater collection systems buried underground in the existing NAVMAG area.

Solid Waste

There are no solid waste facilities near Alternative 4. The GovGuam landfill is located on Dandan Road, past the beginning of the proposed new LFTRC access road. Dandan Road is the primary haul route for trash trucks going to this landfill. Solid waste from the existing NAVMAG facilities is collected, processed, and disposed by contractors for JRM.

Information Technology and Communications

There is existing DoD IT/COMM infrastructure near Alternative 4 at the existing NAVMAG property. There are buried commercial IT/COMM lines along Dandan Road, but none near the proposed LFTRC.

5.4.14.2 Environmental Consequences

Potential impacts to existing utilities from operation of the HG Range would be the same as discussed in Section 5.1.14.2 for Alternative 1.

Electrical Power

The proposed electrical system improvements for Alternative 4, as described in Sections 2.5.4.4 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The electrical power requirements of the LFTRC facilities would be small (less than 50 kW) and thus have minimal long-term impact on the current system or current power customers. During construction, short-term power outages could occur while new power lines are connected to existing power lines, but they are expected to be only about 2 hours.

The short- and long-term, direct impact of LFTRC Alternative 4 on the electrical utility would be less than significant during both construction and operation.

Potable Water

The proposed water system improvements for Alternative 4 as described in Sections 2.5.4.4 and 2.5.4.6 (for HG Range) have been developed to meet the requirements for the proposed action. The KD Rifle/KD Pistol Range Administrative Building is the only facility on the east side of Alternative 4 requiring potable water service. The demand of this facility would be small, estimated at a portion of the total LFTRC average daily demand of 26,520 gallons per day (100,389 liters per day). Therefore, less than significant long-term, direct impact would occur to the current GWA system. During construction, short-term, minor water service outages could occur as new water lines are connected to existing water lines. With careful planning, these potential outages would be minimized.

For Alternative 4, the new water service to the LFTRC facilities on NAVMAG property would connect to the proposed Range Maintenance Building and new fire hydrant. The long-term demand of these LFTRC connections would also be small, estimated at a portion of the total LFTRC average daily demand of 26,520 gallons per day (100,389 liter per day). Therefore, less than significant long-term, direct impact would occur to the current DoD water system. During construction, short-term, minor water service

outages could occur as new water lines are connected to existing water lines. With careful planning, these potential outages would be minimized.

The short- and long-term, direct impact of LFTRC Alternative 4 to the potable water utilities (both DoD and GWA) would be less than significant, during both construction and in operation.

Wastewater

The proposed wastewater collection system improvements for Alternative 4, as described in Sections 2.5.4.4 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The only LFTRC facilities that would generate wastewater would be the Range Maintenance Building and the KD Rifle/KD Pistol Range Administrative Building that would have an estimated wastewater flow less than 0.01 MGd (0.038 MLd). The short- and long-term, direct impacts to the wastewater utility would be the same as for Alternative 3, as discussed in Section 5.3.14.2.

The short- and long-term impact of LFTRC Alternative 4 to the wastewater utility would be less than significant, during both construction and operation.

Solid Waste

The proposed solid waste infrastructure improvements for Alternative 4, as described in Sections 2.5.4.4 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The short- and long-term, direct impacts to the solid waste utility from Alternative 4 would be the same as for Alternative 3, as discussed in Section 5.3.14.

The short- and long-term, direct impact of LFTRC Alternative 4 on the solid waste utility would be less than significant, during both construction and operation.

Information Technology and Communications

The proposed IT/COMM infrastructure improvements for Alternative 4 as described in Section 2.6 have been developed to meet the requirements for the proposed action. LFTRC Alternative 4 would require new conduit duct banks consisting of six 4-inch (10-cm) conduits to interconnect the LFTRC range facilities including the HG Range. There would also be inter-base connectivity required for DoD IT/COMM, as discussed in Section 2.6. Some of these inter-base connections in the southern part of Guam would require new rights of way. Installation of these IT/COMM lines could cause short-term minimal service disruptions to current IT/COMM users. With careful planning, these potential disruptions would be minimized.

The short- and long-term, direct impact to the IT/COMM infrastructure would be less than significant, during both construction and operation.

5.4.15 Socioeconomics and General Services

Most issues and impacts associated with socioeconomics and general services encompass the entire proposed action (i.e., cantonment/family housing and LFTRC development, increased population), and do not vary with site alternatives. Accordingly, the impact discussion in Section 4.1.15 of this SEIS applies for all of the LFTRC alternatives and is incorporated here by reference. Land acquisition, however, is unique to the LFTRC alternatives, and the amount of land to be acquired varies by alternative. Therefore, this section focuses exclusively on the socioeconomic and sociocultural issues and impacts associated with the acquisition of land under Alternative 4 (with the exception of the HG Range, which would not require land acquisition).

5.4.15.1 Affected Environment

Table 5.4.15-1 displays baseline data for land that would be acquired for the NAVMAG (L-Shaped) LFTRC alternative. A total of 974 acres (394 ha) of land would be acquired by the federal government. Most of the land (695 acres [281 ha]) is privately owned, including at least nine of the 30 lots that would potentially be acquired. GovGuam owns 205 acres (83 ha) spread over three lots. Eighteen lots that would be acquired have unknown ownership.

Table 5.4.15-1. Potential Changes due to Land Acquisition
NAVMAG (L-Shaped) - Alternative 4

	Acres (ha)
Potential Increase in Federal Land	974 (394)
Private Land Potentially Acquired	695 (281)
GovGuam Land Potentially Acquired	205 (83)
Guam Ancestral Land Commission Land Potentially Acquired	0
Chamorro Land Trust Commission Land Potentially Acquired	0
Unknown Ownership Land Potentially Acquired	74 (30)
	Lots
Number of Lots Potentially Acquired	30
GovGuam Lots Potentially Acquired	3
Guam Ancestral Land Commission Lots Potentially Acquired	0
Chamorro Land Trust Commission Lots Potentially Acquired	0
Private Lots Potentially Acquired	9
Unknown Lot Ownership	18

Table 5.4.15-2 shows existing land use in the NAVMAG (L-Shaped) acquisition area. Land use on the NAVMAG L-Shaped parcel consists of 792 acres (321 ha) of undeveloped land and 182 acres (74 ha) of conservation land (a portion of the Bolanos Conservation Area), where development is not allowed. The GBSP land classification for the entire acquisition area is Agriculture. However, as described in Section 5.4.6, Land Use, no current agricultural use was identified. None of the acreage currently has a productive economic use.

Table 5.4.15-2. Existing Land Use - NAVMAG (L-Shaped) - Alternative 4

Type of Land Use	***Acres (ha)***	***% Total Acreage***
Total	974 (394)	**100%**
Undeveloped Site in Natural State	792 (321)	81%
Conservation	182 (74)	19%

With regard to the affected fiscal environment of Guam, as stated in Section 5.1.15, GovGuam collected a total of $20.1 million in property tax revenues. These revenues accrue to the GovGuam general fund.

5.4.15.2 Environmental Consequences

The DON is required to comply with federal land acquisition laws and regulations, which include the requirement to offer just compensation to the owner, to provide relocation assistance services and benefits to eligible displaced persons, to treat all owners in a fair and consistent manner, and to attempt first, in all instances, acquisition through negotiated purchase. Specific policies and procedures, including the Uniform Act, are described in detail in Section 5.1.15.2.

While the government is authorized to acquire property through its powers of eminent domain (condemnation), it has been the consistent policy of the DON to acquire real estate through negotiation with owners. Even with a negotiated sale or lease however, "friendly" condemnation may be necessary to

clear problems with title. The DON would comply with all applicable laws and regulations, including the Uniform Act.

In general, assuming voluntary sale or lease of property and conformance with land acquisition laws and regulations, land acquisition impacts from both a socioeconomic and sociocultural perspective would not be considered significant. Should condemnation be necessary as a last resort, while the landowner would be made economically whole by payment of fair market value, such an occurrence could represent an adverse sociocultural impact for that individual landowner. Such instances are expected to be extremely rare or nonexistent during implementation of this proposed action, and collectively would not represent a significant impact.

Socioeconomic and Sociocultural Impacts

Potential impacts associated with land acquisition could affect individual property owners, occupants, the surrounding community, and GovGuam. Economic impacts presented in this section are total impacts, they include impacts that would be generated by the proposed action both directly and indirectly. Individual owners and occupants might be impacted from an economic perspective or a sociocultural perspective. Economic impacts associated with land acquisition are those that are purely financial. Sociocultural impacts associated with land acquisition are less tangible and are based on conceptual frameworks such as social disarticulation and cultural marginalization (the deterioration of social structures, networks, or belief systems), and social and psychological marginalization, stress, and anxiety (a person's loss of confidence in society and themselves, feelings of injustice, and reduced social status). See Appendix D, Section 5.2.2 for more detail.

Individual Owner/Occupants

With regard to economic impacts, if acquisition of privately-owned lots were to occur through negotiated purchase with the owners, there would be no adverse impact. As required under the Uniform Act, the purchase would take place at fair market value. Conversely, if the property was acquired through condemnation the federal government would still be required under the Uniform Act to reimburse the property owner at the fair market value. Therefore, the land acquisition would not cause an adverse economic impact to individual landowners.

With regard to sociocultural impacts, this alternative would require the acquisition of 30 separate lots, including three lots owned by GovGuam. Of the lots required, nine are known to be privately owned and 18 lots have unknown ownership, so up to 27 different private parties could be affected. It is anticipated that, in all cases, a negotiated sale or lease between the federal government and a willing seller would be arranged, and there would be no adverse sociocultural impact. In the unlikely event that the land is acquired through condemnation, it is possible that the individual landowner would potentially consider the forced sale or lease of property to be an adverse impact (despite being paid fair market value).

Community

With regard to economic impacts, the NAVMAG (L-Shaped) lands are either undeveloped in a natural state or represent conservation lands (see Table 5.4.15-2), and no current agricultural activities or other economically productive land uses were identified. Because the land that would be acquired does not currently have an economically productive use, and the fair market value would account for the highest and best use, there would be no adverse economic impact.

With regard to sociocultural impacts, the addition of an estimated 974 acres (394 ha) of federal land on Guam would be considered by some citizens to be an adverse impact due to the current extent of federal

land that is under DoD custody and control (25.9% of all land on Guam, see Section 5.1.15), which would increase to 26.6% with acquisition of the NAVMAG (L-Shaped) parcel. However, because of the DON's commitment to the concept of "net negative," by the end of the Marine Corps relocation there would be no net increase in federal land under the custody and control of the DoD.

Five recreational sites are located in the vicinity of the NAVMAG (L-Shaped) parcel (See Section 5.4.7 of this SEIS). Four of the five recreational sites are located on NAVMAG and are only open to installation personnel and their guests. The remaining recreational site, Talofofo Falls Park and Hiking Trail, is accessible to the public along the existing access road between Route 4 and the Dandan Communication Site and is not located within the land acquisition boundary. Although access to Talofofo Falls Park and Hiking Trail may be temporarily affected during construction activities along the access road, the proposed construction activities along the access road would be short-term in duration, and associated sociocultural impacts would be less than significant.

Government of Guam

The current 695 acres (281 ha) of land in the NAVMAG (L-Shaped) alternative that are privately owned are subject to GovGuam property tax. The average per acre value for these parcels is $206,911. The total tax base for private lands is estimated to be $143.8 million ($206,911 x 695 acres). On this property, land owners pay an estimated $122,232 in property taxes to GovGuam. Acquisition of this property by the federal government would represent a loss of 0.6% of FY 2011 GovGuam property tax revenues, representing an adverse but less than significant impact.

GovGuam owns 205 acres (83 ha) of the land subject to acquisition under this alternative. At present, this land is not developed, leased or otherwise generating income for GovGuam. As such, either a sale or lease would generate a small beneficial economic effect (though less than significant in magnitude).

5.4.16 Hazardous Materials and Waste

The current DoD ROI on Guam for hazardous materials and waste in this section includes the DON property and GovGuam lands proposed for development of an LFTRC. The DON property includes northwestern portions of the NAVMAG site and an area to the northwest of Fena Valley Reservoir. GovGuam lands include undeveloped lands located to the east of the southern portion of the NAVMAG site.

5.4.16.1 Affected Environment

Hazardous Materials and Waste, Contaminated Sites, and Toxic Substances

The affected environment or present conditions at NAVMAG and adjacent GovGuam lands proposed for live-fire training range development are depicted in Figure 5.4.16-1. The affected areas for Alternative 4 encompass the same areas as Alternative 2 and Alternative 3 and are described in Sections 5.2.16 and 5.3.16 of this SEIS.

5.4.16.2 Environmental Consequences

Hazardous Materials and Wastes

The short-term and long-term environmental impacts associated with the development of an LFTRC under Alternative 4 would be similar to those described in Section 5.1.16.2 of this SEIS. However, because the training ranges and associated SDZs would be land based, there would be no direct impacts to open waters. As described in Section 5.1.16.2, direct and indirect impacts would be less than significant.

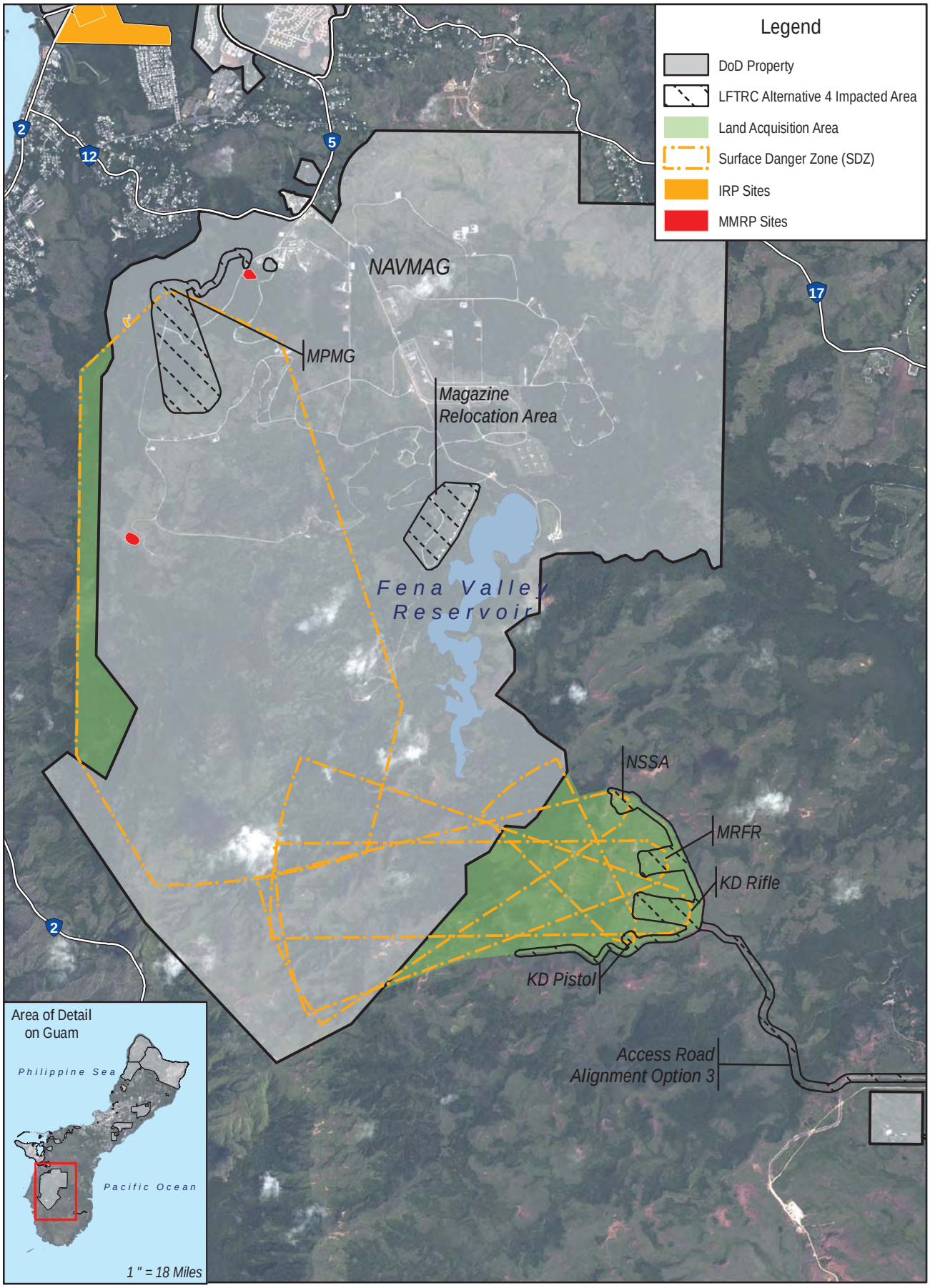


Figure 5.4.16-1
IRP Sites and MMRP Sites in the Vicinity of
NAVMAG (L-Shaped) LFTRC Alternative 4

Contaminated Sites and Toxic Substances

Construction and operation of Alternative 4 would occur in the same areas as Alternative 2 and Alternative 3. Therefore, impacts associated with this alternative would be similar to those described in Section 5.2.16.2 and Section 5.3.16.2 of this SEIS.

5.4.17 Public Health and Safety

5.4.17.1 Affected Environment

Operational Safety

Currently, no vehicle access exists to the southern portion of the area proposed as the NAVMAG (L-Shaped) LFTRC alternative. To protect the general public from intentional or accidental entry onto NAVMAG property, locked or manned gates are used where vehicle access is provided, and a series of warning signs cautioning unauthorized personnel not to enter the area are posted along the perimeter of the installation. Unauthorized personnel are not allowed on the installation at any time.

A small arms range and sniper range are present on the west-central portion of NAVMAG. In addition, an emergency demolition range is present in the central portion of NAVMAG, west of the Fena Valley Reservoir. Both of these ranges are within the SDZ footprint for Alternative 4. Activities at these ranges are conducted in accordance with SOPs to ensure the safety of range participants and the general public.

The munitions operations and storage area and the emergency demolition range on NAVMAG have associated ESQD arcs that restrict the construction of inhabited buildings and other non-munitions related activities, to minimize potential impacts on personnel and the general public from an explosive mishap. Explosives handling and storage is the primary function within the munitions storage area. Detonation of UXO in emergency situations is the primary function of the emergency demolition range.

Environmental Health Effects

Noise

Aviation training is limited to four helicopter landing zones at NAVMAG. Landing Zones 1 and 2 are within proposed SDZs associated with Alternative 4 development. Landing Zone 1 is used in airborne raid-type training associated with an adjacent breacher house. The overflight of helicopters produces noise. However, this training is infrequent and occurs at locations within the installation that is a distance away from populated areas, resulting in no community noise effect. In addition, a small arms range and sniper range are internal to the installation and do not present a current noise management issue.

Land demolition activities take place at the NAVMAG demolition range in the central portion of the installation (approximately 4,100 feet [1,250 m] from the closest public boundary). Although individuals exposed to these noise events may be startled if they are unaware of the source of the noise, the brevity and relative infrequency of activities does not result in noise contours extending onto adjacent public lands. Details regarding current noise conditions at NAVMAG are provided in Section 5.4.4.1.

Water Quality

The Fena Valley Reservoir, which is the primary drinking water source for the southern portion of Guam, is within the NAVMAG boundary. Water quality from the Fena Valley Reservoir and regional springs is generally high, requiring minimum treatment and chlorination for domestic use. Threats to water quality include sedimentation from accelerated erosion, eutrophication because of persistent conditions of low dissolved oxygen, and fecal material contamination from animals (DON 2010a). Section 5.4.2.1 provides details regarding current quality of potable water sources.

Hazardous Substances

Management practices and contingency plans for the use, handling, storage, transportation, and disposition of hazardous substances associated with NAVMAG ensure that exposure to the environment and human contact is minimized.

The IRP focuses on cleaning up releases of hazardous substances that pose risks to the general public and/or the environment. The MMRP focuses on identifying and removing MEC. U.S. Naval Activities Site 35 (Tear Gas Burial Site) is situated in the vicinity of the proposed MPMG live-fire training area, but would not directly affect Alternative 4 development. Contaminants of concern at this site include polynuclear aromatic hydrocarbons. Land use controls are in place at this site. A small arms range and sniper range (MMRP Site UXO 3) are present on the west-central portion of NAVMAG. In addition, an emergency demolition range is present in the central portion of NAVMAG, west of the Fena Valley Reservoir. Activities at these ranges are conducted in accordance with SOPs to ensure the safety of both range participants and the general public. The hazardous materials and waste section of this SEIS (see Section 5.4.16) provides additional details about the status of IRP and MMRP sites.

Unexploded Ordnance

The presence of UXO within Alternative 4 is unknown. However, Guam was an active battlefield during WWII. As a result of the occupation by Japanese forces and the subsequent assault by Allied/American forces to retake the island, unexploded military munitions may still remain.

Traffic Incidents

No high crash frequency locations have been identified in the vicinity of Alternative 4.

5.4.17.2 Environmental Consequences

Potential impacts on public health and safety from implementation of Alternative 4 would be similar to those discussed under Alternative 2.

Operational Safety

Construction Safety

Potential impacts from construction safety would be similar to those discussed for Alternative 2. During construction activities, a health and safety program would be implemented by the construction contractors based on industry standards for accident and pollutant release prevention. Because a health and safety program would be implemented for construction activities, and the general public would be excluded from entering construction areas, potential short-term construction impacts on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to construction activities is anticipated.

Operation/Range Safety

To protect the general public from intentional or accidental entry onto live-fire training ranges, a series of warning signs cautioning unauthorized personnel not to enter the area would be posted along the perimeter of the installation, as well as at the range area. Unauthorized personnel would not be allowed on the installation or range at any time.

SOPs require that before conducting training activities, the general public and non-participating personnel would be cleared from the area so that the only public health and safety issue would be if a training event exceeded the safety area boundaries. Risks to public health and safety would be reduced by confirming

that the training area is clear. The Range Safety Officer would ensure that hazardous areas are clear of personnel during training activities. After a live-fire event, the participating unit would ensure that weapons are safe and clear of live rounds.

Use of established training areas and compliance with appropriate range safety procedures would reduce the potential for interaction between the general public and personnel that are training. Specific and documented procedures would be in place to ensure the general public is not endangered by training activities. Therefore, Alternative 4 would result in no direct or indirect impact on public health and safety from operations and training activities.

Explosive Safety

Ordnance used at the LFTRC would be handled, stored, and transported in accordance with Marine Corps explosive safety directives (MCO P8020.10A, *Marine Corps Ammunition Management and Explosives Safety Policy Manual*), and munitions handling would be carried out by trained, qualified personnel. For the proposed LFTRC under Alternative 4, SDZs were defined for each of the ranges to identify the areas requiring control of unauthorized access to live-fire training operations. The SDZs established for Alternative 4 reflect a "worst case scenario" for weapons use to ensure the safety of on- and off-range personnel and civilians. The proposed layout of the SDZs is provided in Chapter 2. With implementation of appropriate range safety procedures, no direct or indirect impact on public health and safety is anticipated.

The munitions operations and storage area as well as the emergency demolition range on NAVMAG have associated ESQD arcs that restrict the construction of inhabited buildings and other non-munitions related activities, to minimize potential impacts on personnel and the general public from an explosive mishap. The ESQD arcs overlay Alternative 4 firing positions and the associated SDZs. Because the ESQD arcs overlay propose live-fire training firing positions and SDZs, a conflict between the current munitions storage and EOD range activities with the proposed live-fire training activities would occur. However, munitions magazine relocation is included in Alternative 4 to eliminate this conflict. An explosive safety review would be needed to ensure compatible development and use. In addition, SDZs for Alternative 4 activities encumber the existing breacher house, sniper range, EOD range, Landing Zones 1 and 2, and a portion of the non-firing maneuver area, resulting in a safety conflict between the use of these facilities/areas and the proposed live-fire training activities. Use of these facilities/areas would be prohibited when Alternative 4 supports live-fire training. The emergency destruction mission of the EOD range would take precedence over Alternative 4 activities. As part of Alternative 4 development, munitions magazines would be relocated to eliminate the conflict between proposed Alternative 4 live-fire training locations and existing ESQDs for current NAVMAG mission activities, and the conflict between SDZs and current NAVMAG facilities/mission areas. Therefore, no significant safety impacts (direct or indirect) are anticipated if incompatible munitions magazines are relocated.

Environmental Health Effects

Noise

Potential impacts on public health and safety from Alternative 4 noise would be similar to those discussed for Alternative 2. Increases in noise emissions associated with implementation of the short-term construction phase of this alternative with identified BMPs would be less than significant. Enforcement of OSHA guidelines for hearing protection for workers would be the responsibility of the construction contractor. Noise from Alternative 4 activities (i.e., weapons firing) would be heard on adjacent lands from the range. Some adjacent lands north and west of Alternative 4 include residential uses. However,

no people would be exposed to incompatible noise levels (see Section 5.4.4.2 of this SEIS). The sound generated from Alternative 4 activities would be intermittent (only when training activities occur) and short term. This potential noise effect would not result in loss of hearing to nearby residents. Based on the modeled noise for Alternative 4 activities (see Section 5.4.4 of this SEIS), the overall direct or indirect impacts associated with noise on public health and safety would be less than significant.

Water Quality

Potential impacts on public health and safety from water quality concerns would be similar to those discussed for Alternative 2. Water withdrawal would likely increase. However, sustainability practices would be implemented to reduce the amount of water needed (see Section 5.4.2.2 of this SEIS). The resulting total annual water withdrawal would be less than the sustainable yield, and monitoring of water chemistry would identify any emerging issues to ensure no harm to the water supply.

The Fena Valley Reservoir is within the NAVMAG boundary and is the primary drinking water source for the southern portion of Guam. The reservoir is located southeast of Alternative 4 and is outside established SDZs for live-fire training activities. The SDZs define the ground area needed to contain projectiles, fragments, debris, and components resulting from the firing, launching, and/or detonation of weapons. Because Alternative 4 activities would be contained within the designated SDZs, no direct or indirect impact on the Fena Valley Reservoir is anticipated.

Because measures would be taken to maintain a sustainable water supply and the Fena Valley Reservoir is outside the SDZs for the Alternative 4 activities, public health and safety impacts from long-term increased demand on potable water and potential water-related illnesses would be less than significant.

Hazardous Substances

Potential safety impacts from use of hazardous substances would be similar to those discussed for Alternative 2. Implementation of this alternative would result in an increase in the use, handling, storage, transportation, and disposition of hazardous substances. These activities would be conducted in accordance with applicable hazardous material and waste regulations, and established BMPs and SOPs to ensure the health and safety of workers and the general public is maintained. IRP and MMRP investigations and/or remediation activities, as necessary, would continue in an effort to clean up past releases of hazardous substances that pose a risk to the general public and the environment, and receive regulator concurrence that necessary actions have been completed to ensure the safety of the general public. Because hazardous substance management and IRP/MMRP investigative/cleanup activities would be conducted in accordance with applicable regulations and established BMPs and SOPs, no direct or indirect impact on public health and safety is anticipated.

With regard to exposure to airborne toxic dust related to live-fire training activities and range maintenance, lead is the primary contaminant of concern. Very small lead particles can become airborne if wind, foot traffic, or maintenance activities disturb lead-contaminated soil. Firing ranges would be designed and constructed so that participating personnel are not exposed to airborne contaminants above permissible limits. No residential population is located near Alternative 4 on NAVMAG and emissions migrating off range would likely be much lower than on-site. Analysis of firing range emissions presented in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.2.7: Summary of Impacts, Table 5.2-8, page 5-36) indicated that operations emissions from firing range components would be well below significance criteria. Because range maintenance procedures ensure that participating personnel are not exposed to airborne contaminants above permissible limits and analysis of firing range emissions are

below significance criteria, a less than significant direct or indirect impact on public health and safety from firing range activities is anticipated.

Unexploded Ordnance

Potential impacts from UXO would be similar to those discussed for Alternative 2. Excavation for building foundations, roads, underground utilities, and other infrastructure could encounter unexploded military munitions in the form of UXO, DMM, and/or MPPEH. Exposure to MEC could result in death or injury to workers with the exception of public access provisions outlined through the 2011 PA process (see Section 4.4.10, Cultural Resources), the general public would be excluded from entering construction zones and training areas. To reduce the potential hazards related to the exposure to MEC, ESS documentation would be prepared to outline specific measures that would be implemented to ensure the safety of workers and the general public. BMPs that would be implemented would include having qualified UXO personnel perform surveys to identify and remove potential MEC items before beginning ground-disturbing activities. Additional safety precautions would include having UXO personnel supervision during earth-moving activities and providing MEC awareness training to construction personnel involved in grading and excavations before, and during, ground-disturbing activities. In addition, the DON provides MEC awareness training to GovGuam and other public representatives, and allows access to project sites to facilitate surveys or collection of natural resources or items of cultural significance prior to conducting vegetation clearance. Because UXO would be identified and removed before beginning construction activities and construction personnel would be trained about the hazards associated with unexploded military munitions, potential direct or indirect impacts from encounters with UXO would be minimized and would be less than significant.

Traffic Incidents

Potential long-term traffic incident increases would be similar to those discussed under Alternative 2. The potential for increased traffic incidents would be small (5% increase [see Section 4.1.17.2]). Because no high crash frequency intersections are located near NAVMAG and the overall potential long-term increase in the number of traffic accidents as a result of the increase in personnel would be minimal, a less than significant impact from traffic incidents is anticipated on the health and safety of the citizens of Guam.

5.4.18 Environmental Justice and the Protection of Children

5.4.18.1 Affected Environment

The affected environment under the NAVMAG (L-Shaped) alternative is considered to be the entire island of Guam, as discussed in Section 4.1.18.1 of this SEIS. The proposed action under Alternative 4 would occur within the southern region of Guam, as defined in Section 4.1.18.1. The villages of Santa Rita, Agat, Umatac, Talofofo, and Yona are within this region.

5.4.18.2 Environmental Consequences

Potential impacts to environmental justice populations from the NAVMAG (L-Shaped) alternative would be to noise, recreation, land acquisition, and public health and safety. The impact analysis discussion provided in the following sections is focused primarily on operational impacts of implementing proposed LFTRC Alternative 4, as LFTRC construction impacts as related to environmental justice would be minimal and short-term, with no measurable effect on Guam's special-status populations.

Noise

The potential impacts would be the same as Alternative 2.

Recreation

While there are fewer public recreational resources in the south, there are several resources along the coast as described in Section 5.4.7. Potentially-affected resources include Talofofo Falls Park and Hiking Trail.

Construction and/or improvement of access roads on non-federal property would be required to reach the proposed ranges in this alternative. The construction impacts would be temporary and would mostly be limited to construction and earth-moving equipment on public roadways slowing access to recreational resources. There are potential direct impacts from firing range noise, which could lessen visitor enjoyment of publicly-accessible recreational resources in the area of the LFTRC. However the impacts from Alternative 4 would be less than significant due to the lack of existing recreational resources in the areas to be potentially acquired.

Land Acquisition

There would be both beneficial and adverse direct and long-term impacts on adjacent and nearby land uses from the proposed access road/utility easements, as discussed in Section 5.4.6.2, Land and Submerged Land Use. In addition, there would be short- and long-term, direct and indirect significant adverse impacts to land ownership if there is an unsolicited sale of privately-owned land to the federal government for with implementation of Alternative 4. Although there may be landowners who are interested in selling their land, land ownership impacts are considered significant until negotiations have been completed. There would also be other relocation activity and land acquisition, or long-term leases for roadway improvements, to implement this alternative.

Federal regulations regarding land acquisition, such as the DoD's "net negative" strategy outlined in Section 5.1.6, mitigate for the economic impacts experienced by individual landowners and occupants due to land acquisition. However, due to the extent of the proposed land acquisition and potential increase in federally owned or controlled land on Guam, and a reduction in access to lands of sociocultural and recreational importance, the overall socioeconomic impacts of land acquisition would be significant and adverse.

Tier 1: Are there any minority, low-income, or children populations that would be impacted?

Yes, based on the data provided in Section 4.1.18.1, the private landowners are likely to be racial minorities that live in areas with a higher poverty rate than the U.S.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?

No, because all of Guam is considered a racial and ethnic minority population, minorities would not experience disproportionately high and adverse effects due to land acquisition. Because federal regulations regarding land acquisition would ensure that significant economic impacts to landowners and occupants do not occur, low-income populations would not experience disproportionately high and adverse effects due to land acquisition. Land acquisition would not result in health and safety risks that would disproportionately impact children. Therefore, Alternative 4 would not result in disproportionate land use or socioeconomic impacts to minority and low-income populations or children as a result of land acquisition.

Public Health and Safety

The potential impacts would be the same as Alternative 2.

5.5 NORTHWEST FIELD LIVE-FIRE TRAINING COMPLEX - ALTERNATIVE 5

Under Alternative 5, the proposed development of a live-fire training range complex would occur at NWF. Details about this alternative are provided in Section 2.5.4.5 and the proposed site is illustrated in Figure 2.5-6.

5.5.1 Geological and Soil Resources

5.5.1.1 Affected Environment

The affected environment for geological and soil resources associated with Alternative 5 is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.1.2: North, pages 3-14 to 3-15), which is summarized below for reference. The proposed reduction in the number of relocating Marines and dependents under the 2012 Roadmap Adjustments does not alter the description of the affected environment for geological and soil resources, but it would reduce some potential impacts to geological and soil resources that were determined to be less than significant or mitigated to less than significant in the 2010 Final EIS, as described in the analysis of environmental consequences for Alternative 5 below.

Alternative 5 would be located in a near-level area close to Ritidian Point in the northern edge of Guam's limestone structural province (Figure 5.5.1-1). Most of the proposed Alternative 5 footprint stands at an elevation of 500 feet (152 m) above MSL on the top of the limestone plateau. A series of coastal terraces drops down gradually to the west. There are steeper cliffs to the east (Figure 5.5.1-2). All construction for Alternative 5 ranges would take place on the limestone plateau above the cliffs and terraces. The only parts of the project footprint that lie below the plateau are existing USFWS facilities and the proposed construction footprint for the relocated USFS facilities. The elevation at the base of the terraces, where the proposed relocated USFS facilities would be situated, is approximately 60 feet (18 m) MSL. The existing USFWS facilities are located at an elevation of about 15 feet (5 m) MSL. Project-related improvements that would extend onto the beach area would consist only of posting a line of warning signs on the range boundaries and along the beach.

Bedrock underlying the Alternative 5 footprint site is young (Mariana) limestone, the geologic setting for sinkholes (Section 3.1.1.1). Based on available topographic and field data, seven features have been preliminarily identified as sinkholes/depressions that may contain sinkholes within, or on the perimeter of, the proposed Alternative 5 site (Figure 5.5.1-1).

Within the proposed project footprint there are three soil types: Guam Cobbly Clay Loam on the upper plateau (encompassing some or all of the MPMG, KD Pistol, KD Rifle, and MRF ranges); Ritidian-Rock Outcrop Complex on the terraces and cliffs down to the beach (encompassing some or all of the MPMG and Non-standard Small Arms ranges; and Shioya loamy sand on the coastline of the project footprint (Young 1988). For all the soils at the proposed NWF LFTRC site, runoff is slow and the hazard of water erosion is slight (Figure 5.5.1-2). Prime farmland soils, as defined by the USDA, are soils best suited to producing food, seed, forage, fiber and oilseed crops, favorable for economic production and sustained high yield, with minimal inputs of energy and resulting in least damage to the environment (Young 1988). None of the soils in the Alternative 5 footprint are identified by USDA as prime farmland (Young 1988). There is no existing agricultural use, as the area comprises NWF and DOI conservation lands.

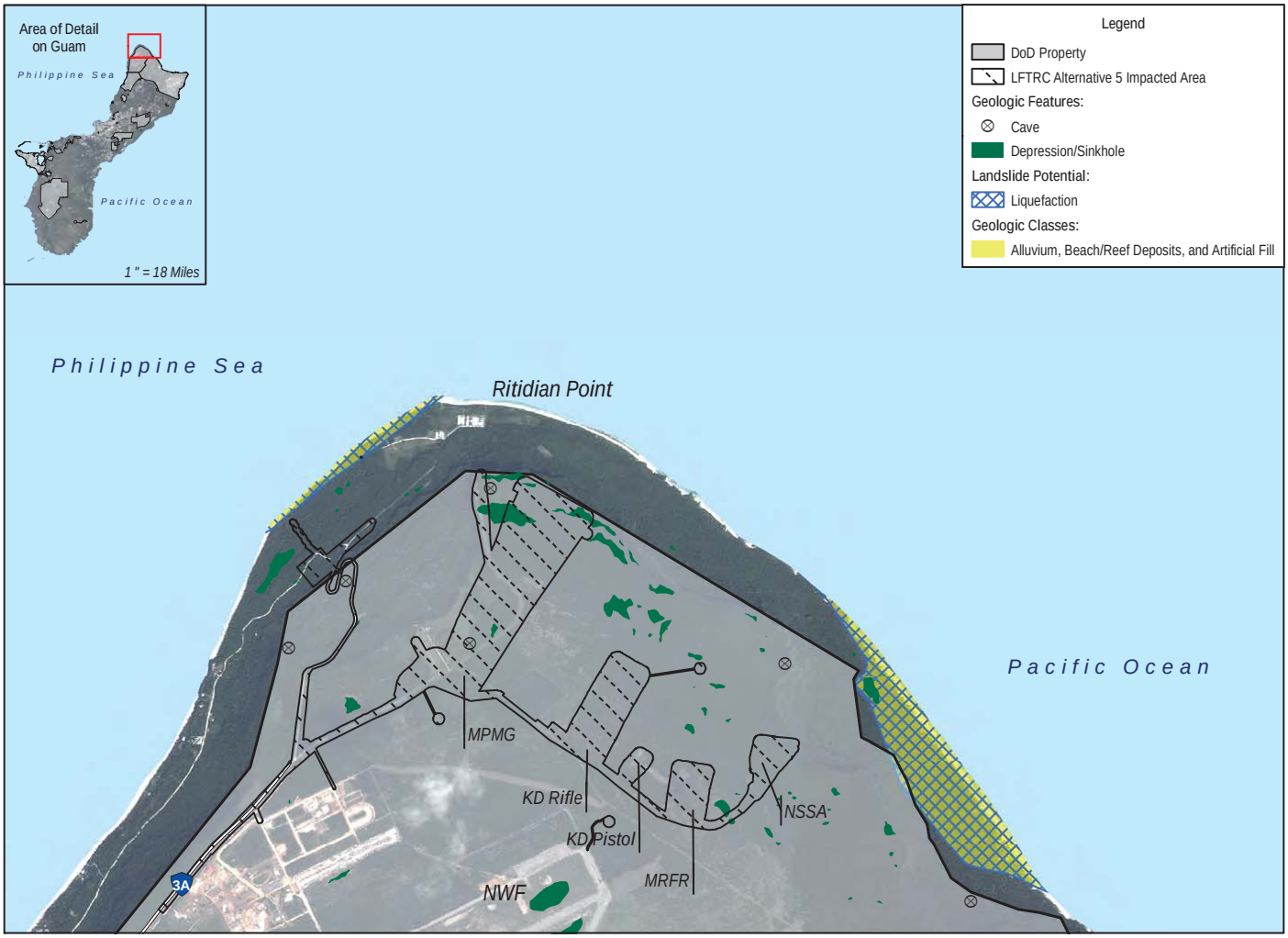


Figure 5.5.1-1
Geologic Features in the Vicinity of
NWF LFTRC Alternative 5

Sources: COMNAV Marianas 2008; GovGuam 2008; NAVFAC Pacific 2013; Taborosi 2004; WERI 2001

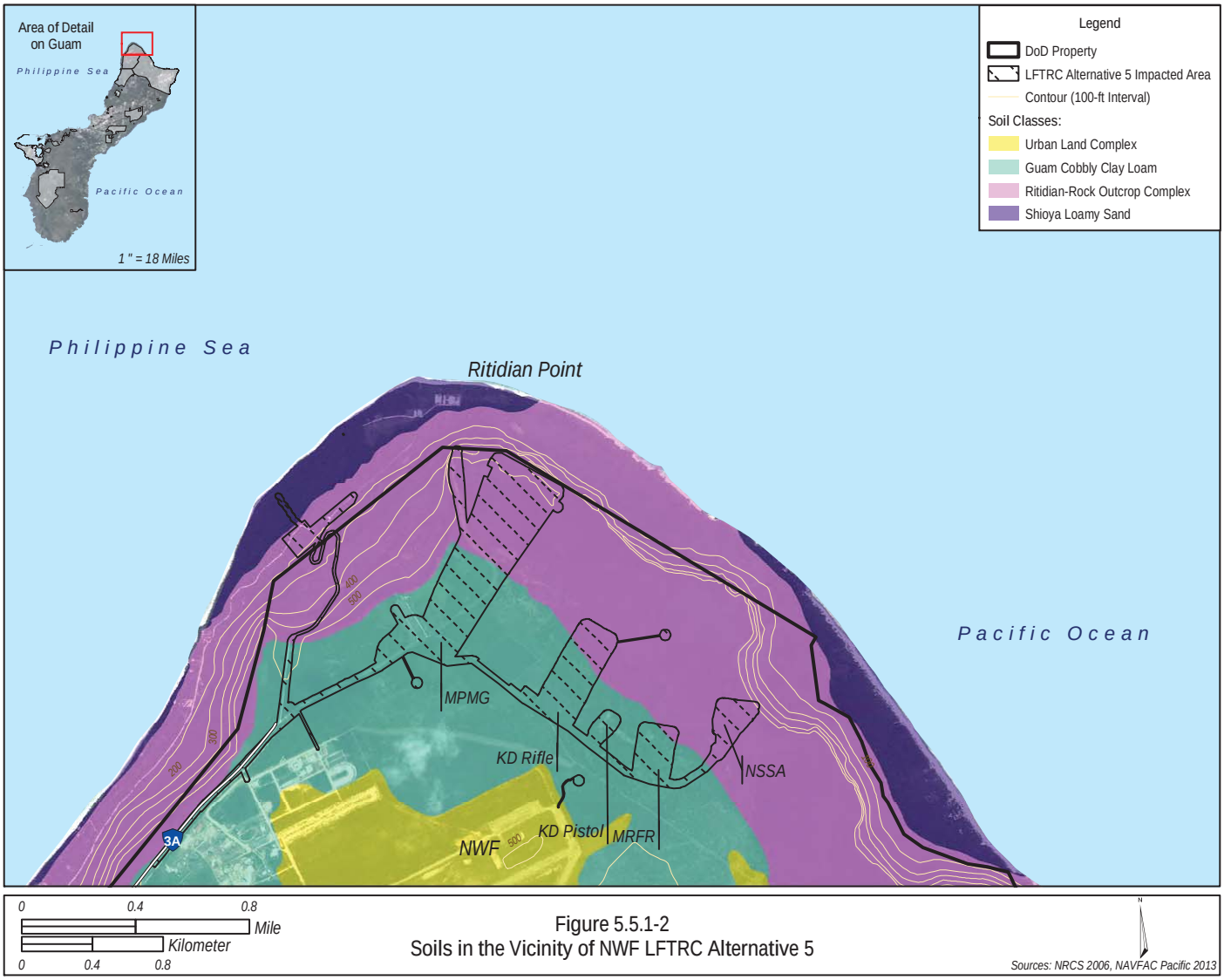


Figure 5.5.1-2
Soils in the Vicinity of NWF LFTRC Alternative 5

The likelihood for landslides to occur in the project footprint is considered low due to the lack of steep slopes (see Figure 5.5.1-2). The maximum reported tsunami wave height reached on Guam was approximately 11.5 feet (3.5 m) MSL in an 1849 tsunami event (GovGuam 2008). The areas proposed for development of Alternative 5 are much higher than the elevation susceptible to tsunamis. However, the existing USFWS facilities are at elevation 15 feet (5 m) MSL, just above the maximum recorded range height of tsunami waves. The Alternative 5 footprint is not subject to liquefaction because it is underlain by consolidated limestone bedrock that does lose not cohesiveness in response to ground shaking during an earthquake (see Figure 5.5.1-1). The limestone bedrock in the area of Alternative 5 presents a potential hazard of surface instability and collapse due to sinkholes.

5.5.1.2 Environmental Consequences

Construction

Potential geology and soil impacts addressed in this section are limited to elements of the proposed action that could affect onshore landforms or that could be affected by geologic hazards. Potential soil contamination issues are addressed in Section 5.5.16.2 of this SEIS (Hazardous Materials and Waste).

Construction impacts associated with the HG Range at Andersen South would be similar to described under Alternative 1 in Section 5.1.1.2 of this SEIS.

Construction activities for Alternative 5 would be similar to those described for Alternative 1, without realignment of Route 15. Similar to Alternative 1, there would be no stream re-routing for construction of Alternative 5. Earthwork would include 2,047,295 yd^3 (1,565,270 m^3) of cut and 1,932,392 yd^3 (1,477,420 m^3) of fill, resulting in a net of 114,903 yd^3 (87,850 m^3) of cut (DON 2103a). Alternative 5 would involve the lowest amount of excavation of all the action alternatives but Alternative 2 (Alternative 3 would involve the greatest; Alternative 2 would require the least). Within the Alternative 5 footprint there are major differences in elevation in the area planned for construction of the MPMG Range. There would be substantial changes to surface elevation for construction of the MPMG Range (DON 2013b). Due to the greater differences in elevation in the planned Alternative 5 MPMG Range area, about 1.5 times as much excavation and fill would be needed overall to construct Alternative 5 compared with Alternative 2. Because of the major elevation changes, the substantial alteration of the surrounding landscape, and the amount of excavation, filling and contouring that would occur, construction of NWF LFTRC Alternative 5 is expected to have a significant direct, long-term impact on topography. Potential mitigation is not considered feasible for this impact because smaller cut/fill volumes would not provide the necessary level surfaces for the referenced ranges. This significant impact to topography would occur with implementation of any LFTRC alternative except Alternative 2, which would involve the least amount of cut and fill (i.e., the impact would be similar for all alternatives except Alternative 2).

Construction of the HG Range would involve 8,894 yd^3 (6,800 m^3) of cut and 12,641 yd^3 (9,665 m^3) of fill, for a net of 3,747 yd^3 (2,865 m^3) of fill. The 114,903 yd^3 (87,850 m^3) of net cut generated by construction of the other Alternative 5 ranges would provide sufficient additional fill to supply the need at the HG Range.

If the existing USFWS facilities are demolished, existing surface elevations would not be changed substantially, so this component of Alternative 5 would have a less than significant direct, long-term impact with respect to topography.

Construction for the Alternative 5 ranges and the relocated USFWS facilities would occur in soil and topographical conditions that are similar to Alternative 1 with respect to the potential for increased soil

erosion. Under Alternative 5, the same engineering controls required by 22 GAR, Chapter 10 Guam Soil Erosion and Sediment Control Regulations would be implemented as BMPs to minimize erosion within the project construction footprint, as for Alternative 1. Similar to Alternative 1, there would be no stream re-routing involved with construction of Alternative 5.

In addition, construction activities associated with Alternative 5 would comply with the Construction General Permit. Potential construction-specific stormwater BMPs would be implemented in compliance with the Construction General Permit. Construction-specific stormwater BMPs would provide erosion and sediment control during the construction period, generally by employing on-site measures that reduce the flow of stormwater and minimize the transport of soils and sediment off-site. Fill material would be generated on-site, whenever possible. In addition, roadway-specific BMPs, as identified in the most recent *CNMI and Guam Stormwater Management Manual*, would be included in the planning, design, and construction of all roadways and facilities. Through compliance with 22 GAR Chapter 10 and the Construction General Permit and implementation of roadway stormwater BMPs, and because the rate of erosion and soil loss would not be substantially increased, direct, short-term impacts to soils from erosion during construction of Alternative 5 (including the relocated USFWS facilities) and possible demolition of the existing USFWS facilities would be less than significant. In addition, no indirect, short-term impacts associated with soil erosion are expected.

The soils that would be disturbed by construction of Alternative 5 are not identified as prime farmland and there is no existing agricultural use. Therefore, disturbance of soil during construction of Alternative 5 would have no direct or indirect impact to agricultural soils.

There are seven features that may contain sinkholes within, or on the perimeter of, the Alternative 5 footprint (see Figure 5.5.1-1). For any sinkholes discovered before or during construction, BMPs would include compliance with 22 GAR Chapter 10 § 10106F. In order to ensure compliance with 22 GAR Chapter 10 § 10106F, BMPs would be modified or an environmental and hydrogeologic assessment must be performed to ensure adverse effects will not result, including but not limited to the displacement of groundwater, interference with well production, significant changes to groundwater recharge, flooding, or the threat or introduction of any pollutant to groundwater. After a preferred alternative is selected and the ROD is signed for the proposed project, final design work would begin for the preferred alternative site. A geotechnical study, including subsurface borings, would be conducted to determine whether the depressions on the site contain sinkhole, and whether there are additional sinkholes not evident from the surface. Hydrogeological studies would be conducted to confirm groundwater flow at the site as well. The geotechnical and hydrogeological studies would be coordinated with the GEPA to design and implement an appropriate analysis. These studies would be part of the final design process and would take place before any construction begins. With implementation of these BMPs, and since no sinkholes would be filled that would adversely affect site drainage, no adverse impacts to sinkholes would occur. Therefore, direct, short-term impacts to sinkholes due to construction of Alternative 5 would be less than significant.

Hazards associated with earthquakes, fault rupture and slope instability would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 (USACE 2013). The consolidated limestone bedrock underlying Alternative 5 footprint (including the USFWS relocation) is not vulnerable to liquefaction, and there would not be a change to soil and/or bedrock conditions that would increase vulnerability to a geologic hazard. If the existing USFWS facilities are demolished, there would be a temporary potential for site workers to be exposed to hazards associated with a tsunami, should one occur. As a BMP to minimize such hazards, the contractor would be required to provide a site-specific health and safety plan that includes notifying workers of the potential tsunami hazard, and communications and

evacuation procedures to be followed to ensure that all site personnel are alerted to an approaching tsunami and move to safety. As stated in the previous paragraph, 22 GAR Chapter 10 § 10106F requires that for sinkholes within the project development footprint that would be modified or used, an environmental and hydrogeologic assessment must be performed to ensure adverse effects will not result. Compliance with these regulations would minimize potential geologic hazards associated with sinkholes. With implementation of procedures to minimize worker exposure to potential tsunami hazards, compliance with 22 GAR Chapter 10 § 10106 and adherence to UFC 3-310-04, construction of Alternative 5 would have less than significant direct and indirect short-term impacts with respect to geologic hazards.

Operation

Operational impacts associated with the HG Range at Andersen South would be similar to those described under Alternative 1 in Section 5.1.1.2 of this SEIS.

Operations at the relocated USFWS facilities would be recreational and administrative and as such would not typically involve activities that would disturb the ground surface, or cause or increase soil erosion. An erosion control plan would be required for maintenance activities, such as occasional utility maintenance, to avoid and minimize potential erosion.

Alternative 5 operations and relocated USFWS facilities would not alter topography post construction, so no direct or indirect impact to topography would occur.

The firing range activities and conditions that may directly cause or increase naturally occurring soil erosion during the operational phase would similar to Alternative 1 and are described in Section 5.1.1.2 of this SEIS. Similar to Alternative 1, under Alternative 5 the significant long-term changes to topography during construction of the MPMG Range are relevant when considering a potential for increase in soil erosion.

The area of impervious surfaces that would be constructed for the ranges and associated infrastructure (range buildings, roads, and parking areas) would be approximately 29.6 acres (12.0 ha) total (Appendix F) including about 28.7 acres (11.6 ha) for Alternative 5 and about 0.9 acre (0.4 ha) for the HG Range. There would be a minor increase in runoff from the new impervious surface area as compared with existing conditions. Stormwater infrastructure improvements included as part of the proposed action would incorporate LID measures and BMPs to minimize soil erosion from increased runoff. Where possible, stormwater flow paths would continue to mimic pre-development flows through area topography. During the operations phase, stormwater BMPs that would be implemented to minimize and control runoff would also minimize soil erosion.

The range complex would be managed in accordance with current Marine Corps range management policies and procedures, which are designed to ensure the safe, efficient, effective, and environmentally sustainable use of the range area. A thorough explanation of Marine Corps range management is detailed in the 2010 Final EIS (Volume 2, Chapter 2: Description of Proposed Action and Alternatives, Section 2.3.1.4: Firing General Military Skills, pages 2-55 to 2-59). Marine Corps range management policies and procedures include procedures for removing expended rounds from live-fire ranges with impact berms (estimated at a minimum of 5 year intervals), managing stormwater, controlling erosion, maintaining vegetation on berms and drainage ways and turf on the range, and restricting vehicular activities to designated/previously identified areas. Range roads would be maintained to minimize erosion.

As indicated in the 2010 Final EIS, the NWF project area overlies the Finegayan and Agafa-Gumas basins of the NGLA. Because the NGLA is used as a source for drinking water, prior to the construction of the ranges, both a site inspection and a site assessment (including installation of four wells at the LFTRC site with associated groundwater sampling and aquifer testing as needed), as well as actual munitions loading data, would be provided to the Marine Corps' REVA and ORC programs. These programs would use the site specific data to determine the appropriate frequency of monitoring and range clearance.

Under the REVA Program, site specific data would be used to evaluate the potential for MCs to reach potential receptors. This would allow the REVA program to determine whether follow-on actions would be required (e.g., sampling, additional studies) and the frequency of any further evaluations. The REVA assessment would use conservative assumptions and available site specific information to determine if modeling can be performed for lead components. Monitoring of the ranges for MCs migrating off-range would be based on the outcome of the REVA assessment. REVA assessments would begin in the first year of operation and would then be conducted at a minimum every 5 years.

The ORC program would not only consider the site-specific and REVA data but also safety and sustainability considerations in its assessmentto determine the required frequency of range clearance.

Munitions constituents associated with small arms ammunition commonly used at operational ranges include lead, antimony, copper, and zinc. Lead is the primary munitions constituent indicator for small arms ranges because lead is the most prevalent (by weight) constituent associated with small arms ammunition. No specific quantitative conclusions can be made regarding the fate and transport of lead, because lead is geochemically specific regarding its mobility in the environment. Site-specific conditions are required (i.e., geochemical properties) in order to quantitatively assess lead migration. Site-specific geochemical properties are only identified via sampling and cannot be observed physically. Without site-specific physical and chemical characterization, lead cannot effectively be modeled using fate and transport modeling. The scientific community has established that metallic lead (such as recently fired, un-weathered bullets and shot) generally has low chemical reactivity and low solubility in water and is relatively inactive in the environment under most ambient or everyday conditions. However, a portion of lead deposited on a range may become environmentally active if the right combination of conditions exists.

As indicated in the above paragraphs, a site inspection and site assessment will be completed at the range and the site-specific information provided to the REVA Manager. The REVA manager will utilize this site-specific information in their assessments of the range, which begin the first year of range operation. Assessing small arms ranges first involves defining and documenting its physical and environmental conditions, as well as how the range is utilized and maintained. The assessment process involves a review of possible factors that can influence the potential for lead to migrate off range including range use and management (source), surface water, groundwater and soil conditions, pathways and receptors (including but not limited to people, sensitive and endangered species). Upon review, if factors or a combination of factors are found to exist that would indicate possible lead migration, REVA program managers consider sampling appropriate media, identifying and implementing BMPs adjustments, or taking other steps as required.

The DON will investigate additional technologies that could assist with range design and minimizing potential impacts (specific technologies or brands were not mentioned to ensure the full range of BMPs are considered). Prior to the construction of the range, the DON will perform a site survey/inspection to inform range design activities, to include evaluating the optimal site grading and any necessary soil amendments to minimize range constituent migration. Appropriate BMPs will be evaluated and incorporated into the design and construction of the range to minimize the off-site migration of stormwater runoff and reduce the infiltration of MCs (e.g. vegetation buffers, pH adjustment of soil and water quality/quantity BMPs). Designs will subsequently be coordinated and approved through Head, Range Design and Safety, Commanding General Marine Corps Combat Development Command.

There would be minor ground disturbance associated with utility maintenance. Construction stormwater BMPs would be implemented during maintenance activities to minimize and control runoff on-site and minimize potential effects of erosion.

A potential indirect impact of firing range operations includes the possibility of live ammunition causing wildland fires. As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's *Wildland Fire Management Plan* (USFS 2008). It would include protocols for monitoring fire conditions and adjusting training as needed. Units undergoing training at the ranges would be briefed by range control on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). With these measures, potential wildfires caused by the live ammunition would be unlikely. Effects to soils from erosion associated with wildfires associated with operation of Alternative 5 would be minimal and direct and indirect impacts would be less than significant.

With implementation of Marine Corps range management policies and procedures, fire suppression and potential mitigation measures, and stormwater BMPs (for ranges and ground-disturbing maintenance) less than significant direct and indirect long-term impacts to soils from erosion would occur due to Alternative 5 range operations.

No prime farmland is identified within the Alternative 5 project footprint. Therefore, there would be no direct or indirect long-term impact to agricultural soils as a result of Alternative 5 operations.

The BMPs for sinkholes would be implemented in the event that maintenance activities should involve sinkholes or their immediate perimeter, so no adverse impacts to sinkholes would occur. Therefore, Alternative 5 operations impacts would have less than significant direct, long-term impacts to sinkholes.

Hazards associated with earthquakes, fault rupture and slope instability would be minimized by adherence to UFC 3-310-04 Seismic Design of Buildings dated June 2013 (USACE 2013) during project design and construction, so direct and indirect long-term impacts with respect to seismic hazards would be less than significant. The consolidated limestone bedrock underlying the Alternative 5 site is not vulnerable to liquefaction. Once constructed, Alternative 5 and the USFWS facilities would be inland and higher than the elevation prone to tsunamis, so would not be susceptible to inundation. There would not be a change to soil and/or bedrock conditions that would increase vulnerability to a geologic hazard. Implementation of sinkhole BMPs would minimize potential geologic hazards associated with sinkholes. Therefore, operation of Alternative 5 would have less than significant direct and indirect long-term impacts with respect to geologic hazards.

5.5.2 Water Resources

5.5.2.1 Affected Environment

The affected environment for water resources at NWF is described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.1.2.1: Andersen AFB, page 4-25). A summary of site conditions for Alternative 5 is provided in Appendix F. The affected environment for the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.1 of this SEIS.

Surface Water

As indicated in the 2010 Final EIS, there are no surface water resources in the project area and there are no 100-year or 500-year flood zones identified within the proposed construction area (Figure 5.5.2-1).

Groundwater

As indicated in the 2010 Final EIS, the NWF project area overlies the Finegayan and Agafa-Gumas basins of the NGLA. There are several depressions/sinkholes located within and in the vicinity of the project area (Figure 5.5.2-1).

Nearshore Waters

Nearshore waters around the NWF project site include Ritidian Point and beach. Use of this area is primarily conservation with the Guam NWR Ritidian Unit being important for biological resources. There is also recreational use in the area (see Sections 5.5.8, Terrestrial Biological Resources and 5.5.7, Recreational Resources, respectively, in this SEIS for more information). As indicated in the 2010 Final EIS, nearshore waters are classified as having M-1 water quality in this area. The SDZ would extend over nearshore waters, including the USFWS Ritidian Point Reserve (Figure 5.5.2-1).

Wetlands

As discussed in the 2010 Final EIS, there are no wetlands in the project area (Figure 5.5.2-1).

5.5.2.2 Environmental Consequences

Construction

General construction impacts to water resources under Alternative 5 would be similar to those described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-84 to 4-88) and under Alternative A in Section 4.1.2.2 of this SEIS. Under Alternative 5, there would be construction activities associated with the proposed LFTRC ranges in the NWF and HG Range project areas. Construction impacts associated with the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.2 of this SEIS.

Similar to Alternative A, Alternative 5 would occur in an area that does not contain any waters of the U.S. but would comply with the Construction General Permit, as described under Alternative A. Construction under Alternative 5 would result in the potential for short-term increases in stormwater runoff and erosion. However, through compliance with the Construction General Permit and Program SWPPP and implementation of a site-specific SWPPP and associated erosion control, runoff reduction, and sediment removal BMPs (see Table 4.1.2-2), these effects would be minimized and off-site transport of stormwater runoff would be unlikely unless during extreme weather events (i.e., typhoons). Specifically, the site-specific SWPPP would identify appropriate BMPs for the site that would serve to contain runoff and sediment on-site by reducing the flow rate of runoff and thereby minimize transport of suspended sediment through settling and promote infiltration of runoff.

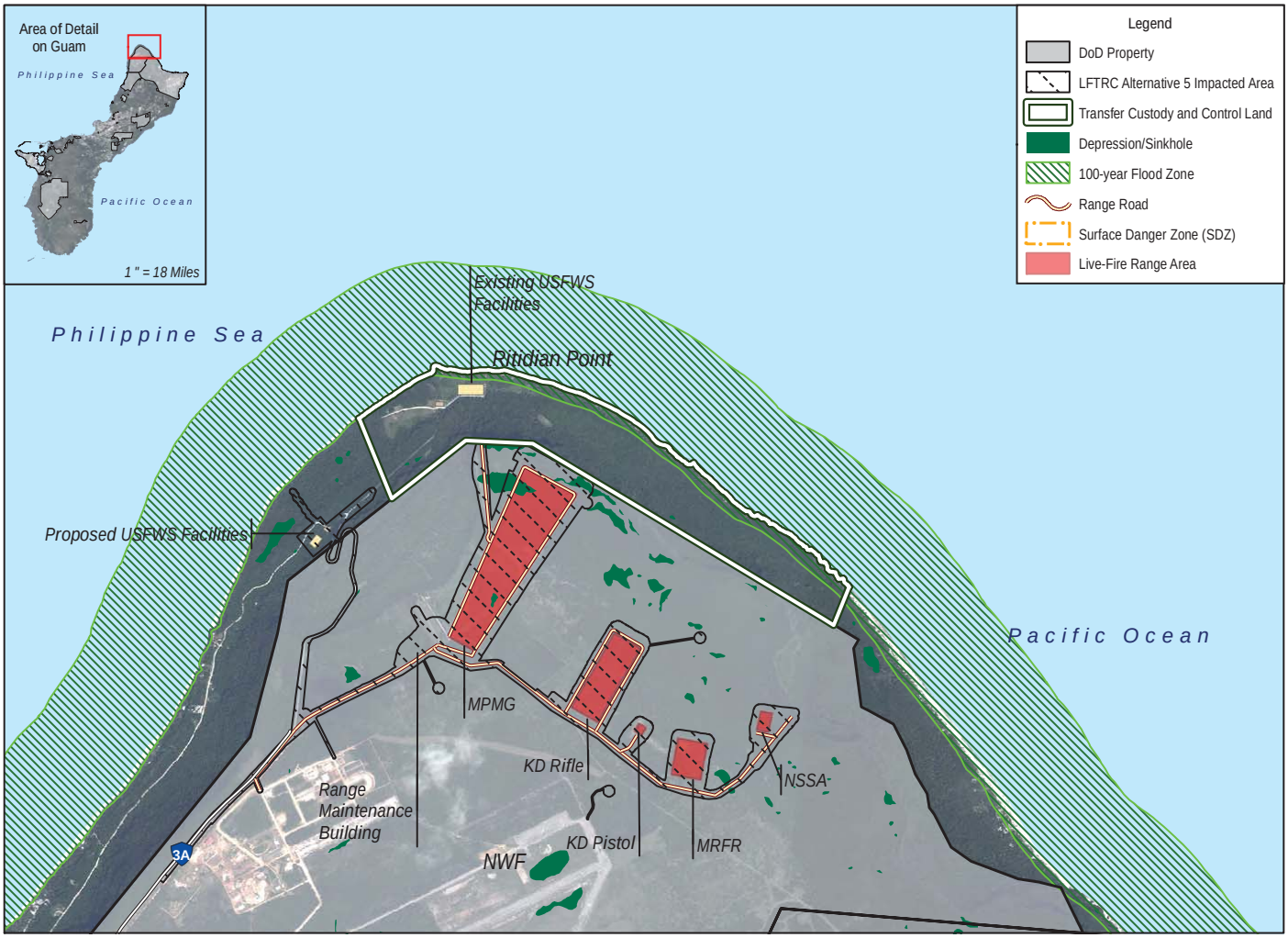


Figure 5.5.2-1
Water Resources in the Vicinity of NWF LFTRC Alternative 5

Surface Water

No buildings/structures would be constructed in the 100-year or 500-year flood zones and no surface waters are located within or near the proposed construction areas under Alternative 5. Given compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely. Therefore, construction activities associated with Alternative 5 would result in no short-term impacts to surface waters.

Groundwater

Construction activities under Alternative 5 would include stormwater runoff protection measures that would also serve to protect groundwater quality. By adhering to the provisions of the Construction General Permit and implementing BMPs associated with addressing site- and activity-specific water resource protection requirements, there would be a reduction in stormwater pollutant loading potential and thus a reduction in pollution loading potential to the underlying groundwater basins of the NGLA. As described under Alternative A, an environmental and hydrogeologic assessment for the selected alternative would be performed for sinkholes within the project development footprint to ensure adverse effects to groundwater resources would not occur. Given stormwater runoff protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs) and the environmental and hydrogeologic assessment for sinkhole protection (if encroachment is unavoidable), construction activities associated with Alternative 5 would result in less than significant short-term, direct or indirect impacts to groundwater.

Nearshore Waters

The project area would be located approximately 0.04 mile (0.06 km) from nearshore waters (see Figure 5.5.2-1). Given compliance with the Construction General Permit and implementation of a Program SWPPP and site-specific SWPPP, off-site transport of stormwater runoff, sediment, or other pollutants would be unlikely (see discussion of BMPs under *Construction*). In addition, vegetative cover between the construction area and the edge of the steep cliffline and the shoreline would provide an additional buffer and protection from stormwater runoff or sediment reaching nearshore waters. Given adherence to the provisions of the Construction General Permit and implementation to BMPs, it is expected that stormwater runoff, sediment, or other pollutants would not discharge to nearshore waters. Therefore, construction activities associated with Alternative 5 would result in no impacts to nearshore waters.

Wetlands

No wetlands are located in or near the construction areas associated with Alternative 5. Therefore, construction activities associated with Alternative 5 would result in no impacts to wetlands.

Operation

Alternative 5 would incorporate the concept of LID in the final planning, design, and permitting of the stormwater runoff and drainage design as described in the 2010 Final EIS (Volume 2, Chapter 4: Water Resources, Section 4.2.2.1: North, pages 4-85 to 4-87) and under Alternative A in Section 4.1.2.2 of this SEIS. Operation impacts associated with the HG Range at Andersen South would be the same as described under Alternative 1 in Section 5.1.2.2 of this SEIS.

Under Alternative 5, there would be a minor increase in the area of impervious surface as a result of training buildings and complexes, which would result in an associated increase in stormwater discharge intensities and volume. However, increases in stormwater runoff from increased impervious area would be accommodated through the implementation of LID measures and BMPs. Alternative 5 would potentially increase the amount of POLs, hazardous waste, herbicides, pesticides, and fertilizers being stored, transported, and utilized on the proposed facilities. However, impacts from these contaminants would be minimized with the implementation of a SWPPP, SWMP, and SPCC plan.

Alternative 5 would include implementation of the REVA program and range management preventative measures (i.e., vegetation, pH adjustment, LID). As listed in Section 2.8 of this SEIS, the BMPs would reduce the potential for contaminants to migrate off-site. In addition, the DoD would investigate additional technologies that could assist with range design and management to minimize potential impacts. Available baseline data regarding range site conditions would be reviewed and verified prior to range construction and quarterly monitoring would occur during operations to verify the effectiveness of BMPs. For each range, water quality treatment strategies would be selected to achieve reductions of non-point source pollutants to meet the same water quality requirements as identified under Alternative A in Section 4.1.2.2 of this SEIS.

Surface Water

No surface waters are located within the Alternative 5 project area and the implementation of an appropriate and comprehensive stormwater management plan utilizing a LID approach and range management BMPs would ensure that there would be no increase in off-site transport of excess stormwater runoff, sediment, or other pollutants for up to the 25-year design storm event. Therefore, Alternative 5 would result in no impacts to surface water.

Groundwater

Range operations under Alternative 5 have the potential to leach MCs to the water. However, range management BMPs would be implemented, as listed in Section 2.8 of this SEIS. As indicated in the 2010 Final EIS, the NWF project area overlies the Finegayan and Agafa-Gumas subbasins of the NGLA. Because the NGLA is used as a source for drinking water, prior to the construction of the ranges, both a site inspection and a site assessment (including installation of four wells at the LFTRC site with associated groundwater sampling and aquifer testing as needed), as well as actual munitions loading data, would be provided to the Marine Corps' REVA and ORC programs. These programs would use the site specific data to determine the appropriate frequency of monitoring and range clearance.

Under the REVA Program, site specific data would be used to evaluate the potential for MCs to reach potential receptors. This would allow the REVA program to determine whether follow-on actions would be required (e.g., sampling, additional studies) and the frequency of any further evaluations. The REVA assessment would use conservative assumptions and available site specific information to determine if modeling can be performed for lead components. Monitoring of the ranges for MCs migrating off-range would be based on the outcome of the REVA assessment. REVA assessments would begin in the first year of operation and would then be conducted at a minimum every 5 years.

The ORC program would not only consider the site-specific and REVA data but also safety and sustainability considerations in its assessment to determine the required frequency of range clearance.

Munitions constituents associated with small arms ammunition commonly used at operational ranges include lead, antimony, copper, and zinc. Lead is the primary munitions constituent indicator for small arms ranges because lead is the most prevalent (by weight) constituent associated with small arms ammunition. No specific quantitative conclusions can be made regarding the fate and transport of lead, because lead is geochemically specific regarding its mobility in the environment. Site-specific conditions are required (i.e., geochemical properties) in order to quantitatively assess lead migration. Site-specific geochemical properties are only identified via sampling and cannot be observed physically. Without site-specific physical and chemical characterization, lead cannot effectively be modeled using fate and transport modeling. The scientific community has established that metallic lead (such as recently fired, un-weathered bullets and shot) generally has low chemical reactivity and low solubility in water and is relatively inactive in the environment under most ambient or everyday conditions. However, a portion of lead deposited on a range may become environmentally active if the right combination of conditions exists.

As indicated in the above paragraphs, a site inspection and site assessment will be completed at the range and the site-specific information provided to the REVA Manager. The REVA manager will utilize this site-specific information in their assessments of the range, which begin the first year of range operation. Assessing small arms ranges first involves defining and documenting its physical and environmental conditions, as well as how the range is utilized and maintained. The assessment process involves a review of possible factors that can influence the potential for lead to migrate off range including range use and management (source), surface water, groundwater and soil conditions, pathways and receptors (including but not limited to people, sensitive and endangered species). Upon review, if factors, or a combination of factors are found to exist that would indicate possible lead migration, REVA program managers consider sampling appropriate media, identifying and implementing BMPs adjustments or taking other steps as required.

Additionally, the proposed ranges at NWF would be located down-gradient from and approximately 2 miles (3 km) from the nearest active groundwater well (AF-5) (Figure 5.5.2-2). HQMC also commissioned a study on the effects of pumping and drought on the NGLA (USGS Scientific Investigations Report 2013-5216: *The Effects of Withdrawals and Drought on Groundwater Availability in the Northern Guam Lens Aquifer, Guam*). Information from this report will be used to adjust pumping rates in order to avoid increased salinization and reversal of groundwater flow patterns. The overall flow of groundwater in this area would not be altered by proposed future pumping rates, groundwater would not flow towards drinking water production wells. Given stormwater runoff protection measures (i.e., implementation of LID, BMPs, operation and maintenance programs) and location of range activities in relation to active wells, operations associated with Alternative 5 would result in less than significant long-term, direct or indirect impacts to groundwater.

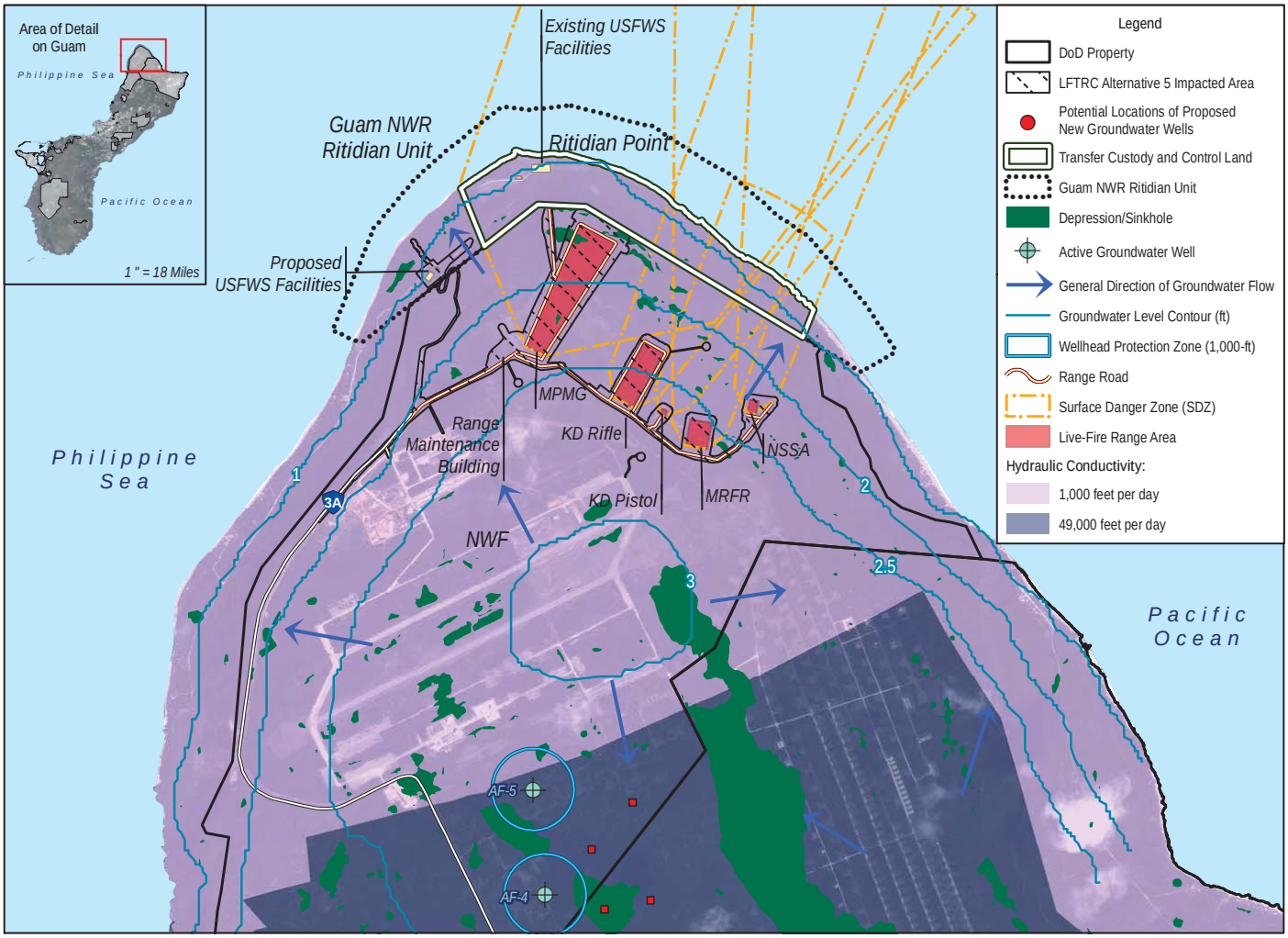


Figure 5.5.2-2
Groundwater Wells and Flow Direction in the Vicinity of NWF LFTRC Alternative 5

Sources: FEMA 2007; USGS 2003, 2013; NAVFAC Pacific 2013; WERI 2001

Nearshore Waters

Under Alternative 5, proposed operations would be in compliance with the stormwater runoff protection measures identified above that would ensure that there would be no increase in off-site transport of stormwater runoff, sediment, or other pollutants to nearshore waters for up to the 25-year design storm event. In addition, vegetative cover between the project area and the edge of the steep cliffline and the shoreline would provide an additional buffer and protection from stormwater runoff or sediment reaching nearshore waters. Therefore, there would be no impacts to nearshore waters from stormwater runoff associated with increased impervious areas and training activities under Alternative 5.

The SDZ associated with the Alternative 5 LFTRC ranges would overlap nearshore waters by approximately 3,059 acres (1,238 ha) (see Figure 5.5.2-1). There would be a very small chance that an expended projectile would fall outside of the range footprint, within the SDZ. There would be an even smaller chance for an expended projectile to fall within the nearshore water portion of the SDZ. Due to the small number of potential projectiles that could fall into the nearshore SDZ and the relatively small size of the projectiles, potential impacts to nearshore water quality from these projectiles would be negligible under Alternative 5.

Wetlands

No wetlands are located within or near the proposed operational areas under Alternative 5. Therefore, operations associated with Alternative 5 would result in no impacts to wetlands.

5.5.3 Air Quality

5.5.3.1 Affected Environment

Because of the proximity to AAFB, ambient air quality conditions around the site for Alternative 5 are affected primarily by various operational activities occurring at the base from stationary and mobile emissions sources, including aircraft, vehicles along Route 3A, and various stationary boilers and generators, as discussed in Section 4.3.3.

5.5.3.2 Environmental Consequences

The construction activities associated with Alternative 5 would be similar to Alternative 1, with the exception of site location. Therefore, the predicted construction activity annual emissions would be the same as Alternative 1, as summarized in Table 5.1.3-2, and are well below the significance criterion of 250 tpy.

The hot-spot air quality impacts during both construction and operational phases would be similar to Alternative 1, as discussed in Section 5.1.3; resulting in less than significant short- and long-term hot-spot air quality impacts.

5.5.4 Noise

5.5.4.1 Affected Environment

Existing noise levels at NWF are composed of airfield operations in flight tracks going to and from AAFB, aviation training at NWF, and ground-based training. AAFB's most recent AICUZ study was funded by NAVFAC Southwest and was completed in 2014. As discussed in the 2010 Final EIS (Volume 2, Chapter 6: Noise, Section 6.1.2: Affected Environment, pages 6-10), aviation training activities at NWF include familiarization training and field carrier landing practice for helicopters and airlift operations by H-60, H-46, H-53, V-22, H-1 and C-130 aircraft. Noise contours from airfield operations operating from AAFB are shown on Figure 4.1.4-1 in Chapter 4 of this SEIS. Because aircraft operations at NWF are not frequent, amounting to approximately 80 operations per year, an AICUZ study specifically for NWF has not been prepared. However, single event SELs due to helicopters operating directly overhead can reach 94 dBA at 100 feet (30 m) but operations occur in the interior of NWF and generally attenuate to below 70 dBA at the property line and up to 76 dB with four helicopters operating simultaneously. A number of flight paths for aircraft operating from AAFB occur over NWF and although the AICUZ noise contours of 65 dBA or greater do not reach NWF, jet aircraft such as F-22 and F/A-18 operating along these flight tracks can generate single event SELs in excess of 100 dBA. In particular, departure routes 4RD2 and 4RD3 are about 1 mile (1.6 km) from Ritidian Point and an SEL of up to 101 dBA from an F-22 can be experienced at Ritidian Point.

In addition to aviation training, ground-based training occurs for force protection using pyrotechnics, ground burst simulators, smoke grenades, and 40-pound cratering charges. Noise levels from these operations are within Noise Zones 2 and 3 and are confined within NWF. These noise events are dominated by the demolition charges which are impulsive sounds and generate CDNL of less than 62 dBC at the boundary of NWF. The 2010 Final EIS (Volume 2, Chapter 6: Noise, Section 6.1.2: Affected Environment, pages 6-11 to 6-12) describes ground-based training in further detail.

5.5.4.2 Environmental Consequences

Construction

Similar to Alternatives 2, 3, and 4, there would be no impact due to construction noise under Alternative 5 because construction activities would be within NWF and away from any sensitive human receptors. Construction areas along the access road to Ritidian Point would be approximately 0.25 mile (0.4 km) away from the nearest receptors, a distance that is far enough away from the source of construction noise such that there would be minimal noise effects on receptors.

Operation

The noise modeling results for Alternative 5 (Army 2013) are shown on Figure 5.5.4-1. Under Alternative 5, the Zone 2 noise contours cover approximately 48 onshore acres (19 ha) beyond the boundaries of DoD land at NWF or DOI land onto private property near the entrance to the Ritidian Unit of the Guam NWR and Jinapsan Beach. Offshore, Zone 2 would cover approximately 389 acres (157 ha) but no Zone 3 contours extend offshore. No residents would be affected by Zones 2 and 3 noise levels because there are no homes located under any of the contours.

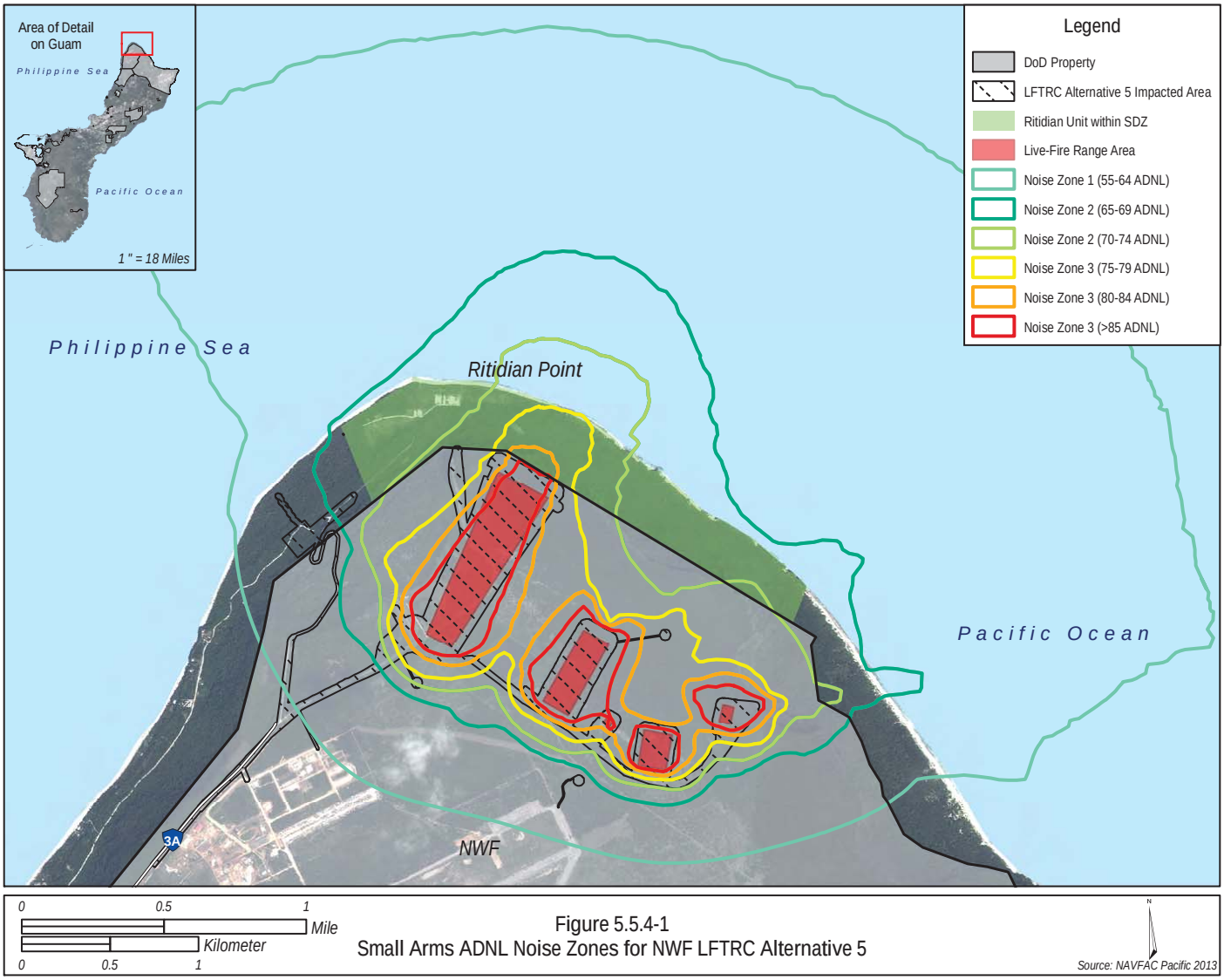


Figure 5.5.4-1
Small Arms ADNL Noise Zones for NWF LFTRC Alternative 5

For the NWF alternative, there are no inhabited homes located under the compatible Zone 1 contours as well. Table 5.5.4-1 lists the Noise Zones and the associated acreage affected within each zone. There are a few uninhabited homes near Jinapsan Beach, but these homes would be within Noise Zone 1, although one house appears to be close to Zone 2. Noise contours that result from Joint Service users at the LFTRC would fall within the contours shown, because the noise contours were calculated as an average busy day and the use by other services would be more infrequent and less intense than Marine Corps usage.

Table 5.5.4-1. Noise Exposure within Noise Zones under LFTRC Alternative 5

Noise Zone (dB DNL)[1]	*Acreage (ha)*				*Population*	
	On-base[2]		*Off-base*			
	DoD	*DOI*	*Onshore*	*Offshore*	*Houses*	*People*
Noise Zone 2						
65 - 69	134 (54)	173(70)	45 (18)	315 (127)	0	0
70 - 74	232 (94)	55 (22)	3 (1)	74 (30)	0	0
Total Zone 2	**366 (148)**	**228 (92)**	**48 (19)**	**389 (157)**	**0**	**0**
Noise Zone 3						
75 - 79	190 (77)	33 (13)	0	0	0	0
80 - 84	116 (47)	6 (2)	0	0	0	0
85+	186 (75)	0 (0)	0	0	0	0
Total Zone 3	**492 (199)**	**39 (15)**	**0**	**0**	**0**	**0**
Grand Total	**858 (347)**	**267 (107)**	**48 (19)**	**389 (157)**	**0**	**0**

Notes: [1] Zone 1 is not listed because all land uses are compatible within Zone 1.
[2] On-base includes end-state restricted access areas.
Source: Army 2013, NAVFAC Pacific 2013.

Although there would be noise due to LFTRC activities combined with the existing aviation and ground-based training, noise is modeled independently because noise from each noise source (aircraft, explosives, and small arms) is estimated using different models for each source. Explosion noise from ground-based training is estimated using the C-weighted metric, and mathematically it cannot be added to the small arms noise contours. Qualitatively, none of the noise-generating activities would create incompatible land use impacts and adversely affect individual human populations. Collectively, the noise-generating activities would not likely combine to create incompatible land use because noise from each activity is low at the nearest receptors.

In addition, the nearest noise receptors are located at the base of the cliff, while the noise-generating activities would be on the bluff above with the land providing a natural sound barrier. However, officially recognized noise models for small arms range noise are unable to account for the presence of a steep cliff northwest of the proposed LFTRC. Actual noise levels are anticipated to be 5-15 dBA less than the modeled noise levels below the cliffline (personal communication, M. Downing, Blue Ridge Research and Consulting, February 2014).

Under Alternative 5, no people would be impacted by Zone 2 or 3 noise levels because there are no residences within these zones. Military members assigned to the Pacific Regional Training Center (PRTC) and Joint Threat Emitter that work and/or live at NWF are not located in Zones 2 or 3 and would not be exposed to incompatible noise levels. Potential noise effects on Joint Threat Emitter equipment are under review by DoD. There would be no direct impacts due to live-fire training noise under this alternative and none of the noise significance criteria stated in the Marine Corps Guidance memo for land use and noise exposure would be exceeded (Marine Corps 2005). There would be no direct or indirect impacts because none of the impact assessment criteria related to potential noise impacts would be exceeded. As described in Section 5.1.4.2, noise levels at the HG Range would remain within Andersen South and not impact any residences. In summary, there would be no residences/households affected by

noise resulting from implementation of Alternative 5 and, consequently, no significant noise impacts would occur.

5.5.5 Airspace

5.5.5.1 Affected Environment

The existing airspace conditions for Alternative 5 would be the same as described for Alternative 1 (see Section 5.1.5.1). Detailed information on military and civilian air traffic associated with AAFB and Guam International Airport, respectively, is provided in the 2010 Final EIS (Volume 2, Chapter 7: Airspace, Section 7.1: Military Air Traffic, pages 7-8 to 7-10).

5.5.5.2 Environmental Consequences

Construction

No changes to airspace would be required during construction of the LFTRC under Alternative 5, and construction activities would not be expected to conflict or interfere with the use or management of existing airspace in the vicinity. Therefore, construction of the LFTRC under Alternative 5 would have no impact on airspace.

Operation

Figure 5.5.5-1 depicts the proposed Restricted Area associated with Alternative 5. This SUA would be needed to contain the vertical hazard associated with the proposed live-fire training. The proposed NWF Option of R-7202 Guam would be structured as an overall airspace area with three distinct segments that could be operated individually or as a whole. The boundary coordinates of the overall R-7202 Restricted Area would begin at:

- lat.13º41'42"N., long.144º52'9"E
- to lat.13º40'48"N., long.144º54'4"E
- to lat.13º38'13"N., long.144º52'43" E
- to lat.13º37'56"N., long.144º52'22"E
- to lat.13º38'36"N., long.144º51'5"E
- to the point of beginning

Segment A of the proposed R-7202 Guam would begin at:

- lat.13°41'42"N., long.144°52'9"E
- to lat.13°40'48"N., long.144°54'4"E
- to lat.13°39'52"N., long.144°53'35"E
- to lat.13°40'20"N., long.144°52'41"E
- to lat.13°40'3"N., long.144°52'31"E
- to lat.13°40'3"N., long.144°52'14"E
- to lat.13°39'7"N., long.144°52'15"E
- to lat.13°38'11"N., long.144°51'54"E
- to lat.13°38'36"N., long.144°51'5"E
- to the point of beginning

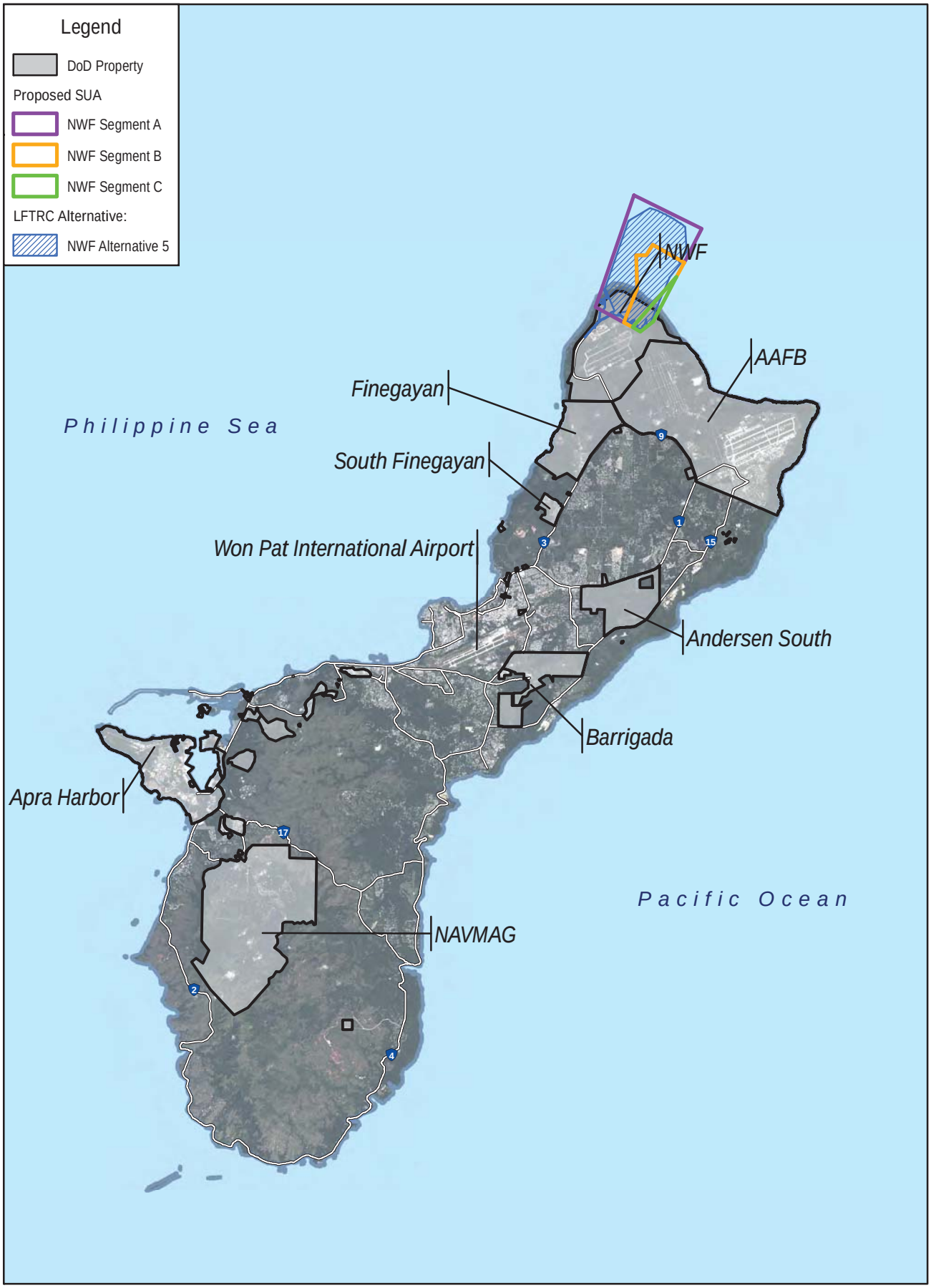


Figure 5.5.5-1
Proposed SUA Associated with LFTRC Alternative 5

Segment B of the proposed R-7202 Guam would begin at:

- lat.13°40'20"N., long.144°52'41"E
- to lat.13°39'52"N., long.144°53'35"E
- to lat.13°39'27"N., long.144°53'22"E
- to lat.13°38'3"N., long.144°52'9"E
- to lat.13°38'11"N., long.144°51'54"E
- to lat.13°39'7"N., long.144°52'15"E
- to lat.13°40'3"N., long.144°52'14"E
- to lat.13°40'3"N., long.144°52'31"E
- to the point of beginning

Segment C of the proposed R-7202 Guam would begin at:

- lat.13°38'3"N., long.144°52'9"E
- to lat.13°39'27"N., long.144°53'22"E
- to lat.13°38'13"N., long.144°52'43"E
- to lat.13°37'56"N., long.144°52'22"E
- to the point of beginning

Altitudes for all proposed segments, times of use, and controlling and using agencies for this Restricted Area SUA would be the same as described in Section 5.1.5.2 for LFTRC Alternative 1 at Route 15. The proposed CFA associated with the HG Range at Andersen South would be the same as described in Section 5.1.5.2 and depicted in Figure 5.1.5-4.

Section 3.5.3.1 identifies the potential impacts to airspace from implementation of the LFTRC alternatives. Due to the proximity of Alternative 5 to AAFB, there would be additional concerns. The AAFB VFR reporting point at Ritidian Point (also known as "Northpoint") would be located within the proposed Restricted Area. This proposed Restricted Area would also encumber certain instrument approach procedures at AAFB, portions of the AAFB radar traffic pattern, and circling procedures for Category E aircraft for both AAFB runways. Minimum/emergency safe sectors and altitudes would require updating. In addition, when the LFTRC was active, coordination would be required to conduct simultaneous operations at the NWF landing zone and drop zone due to overflight restrictions imposed by the LFTRC to the north and the MSA to the south. Potential mitigation measures for these impacts are subject to ongoing actions between the Marine Corps, Air Force, and FAA.

Operational activities under Alternative 5 have the potential for direct impacts to aviation due to the following:

- AAFB instrument approach procedures.
- Standard Instrument Departures and Standard Terminal Arrivals.
- IFR/VFR traffic flows and terminal operations.
- Known but uncharted high volume routes.
- AAFB airspace.
- Existing SUA/Terminal Radar Service Area.
- VFR Reporting Points.

The FAA stated in the preliminary Airspace Feasibility Assessment that Alternative 5 is feasible (FAA 2013). Based on FAA's review and the OPNAV assessment, this alternative would have less than significant direct impacts to civil aviation and the national airspace system. However, it would have potentially significant impacts to military air operations in and around AAFB that require deconfliction, and some mitigation would still be required to lessen impacts on AAFB operations. The Commanders of Pacific Air Forces and Marine Forces Pacific have agreed to a memorandum of agreement detailing specific mitigation measures. As detailed in Table 5.7-1, operational impacts to civil aviation under Alternative 5 would be the least of all alternatives.

5.5.6 Land and Submerged Land Use

5.5.6.1 Affected Environment

A large portion of the Ritidian Unit of the Guam NWR would be affected by Alternative 5. The Guam NWR is federal land. The Ritidian Unit of the Guam NWR is comprised of 370.6 acres (150.0 ha) of federal terrestrial land and 401.5 acres (162.5 ha) of federal submerged land under the custody and control of DOI, which has administrative responsibility over the property to meet the DOI mission. The SDZs would affect the federally owned submerged lands under the custody and control of DON north of the Ritidian Unit of the Guam NWR (Figure 5.5.6-1).

There are two private land parcels on the coastlines located east and southwest of the Ritidian Unit of the Guam NWR. The proposed Alternative 5 footprint encumbers the majority of the Ritidian Unit of the Guam NWR and is adjacent to the eastern private land.

All LFTRC alternatives include an HG Range at Andersen South, the affected environment and impacts of which are described in Section 5.1.6.

The primary land use at NWF is aviation and ground maneuver training, as described in the 2010 Final EIS (Volume 2, Chapter 8: Land and Submerged Land Use, Section 8.1, Affected Environment, pages 8-19 to 8-25). Existing land uses at the LFTRC include the Ritidian Unit of the Guam NWR located along the cliff and coastline, including USFWS facilities and associated parking.

The proposed LFTRC is north of the NWF expeditionary runways that generate APZs adjacent to the proposed LFTRC, as shown in Figure 5.5.6-1. The NWF area is used for a variety of airfield and ground training exercises. The PRTC is located southwest of the proposed LFTRC. Land use constraints in the NWF area include SDZs and ESQD arcs and water wellhead protection buffers. The Ritidian Aid to Navigation, consisting of a flashing light and a daymark mounted to a tower, is located at the cliff edge, as shown on Figure 5.5.6-1. The AAFB land use plans identify the area within the NWF LFTRC as Park/Open Space.

The DOI-controlled land is naturally-vegetated land that is used for conservation with an administrative building, an access road and parking areas. There are other land uses within the proposed LFTRC and vicinity that are addressed under Terrestrial Biological Resources, Marine Biological Resources, and Recreational Resources (Sections 5.5.8.2, 5.5.9.2 and 5.5.7.2, respectively).

The North and Central Land Use Plan designation for the DOI-controlled lands is “federal” and the private properties are designated Tourist/Resort (Figure 5.5.6-1). Access to the western private property is via Route 3A through AAFB property, under agreement with the landowners, GovGuam and DoD. The road is in poor condition. The existing development is low density with few permanent buildings. The land uses include gardening, swimming, fishing, and social gatherings.

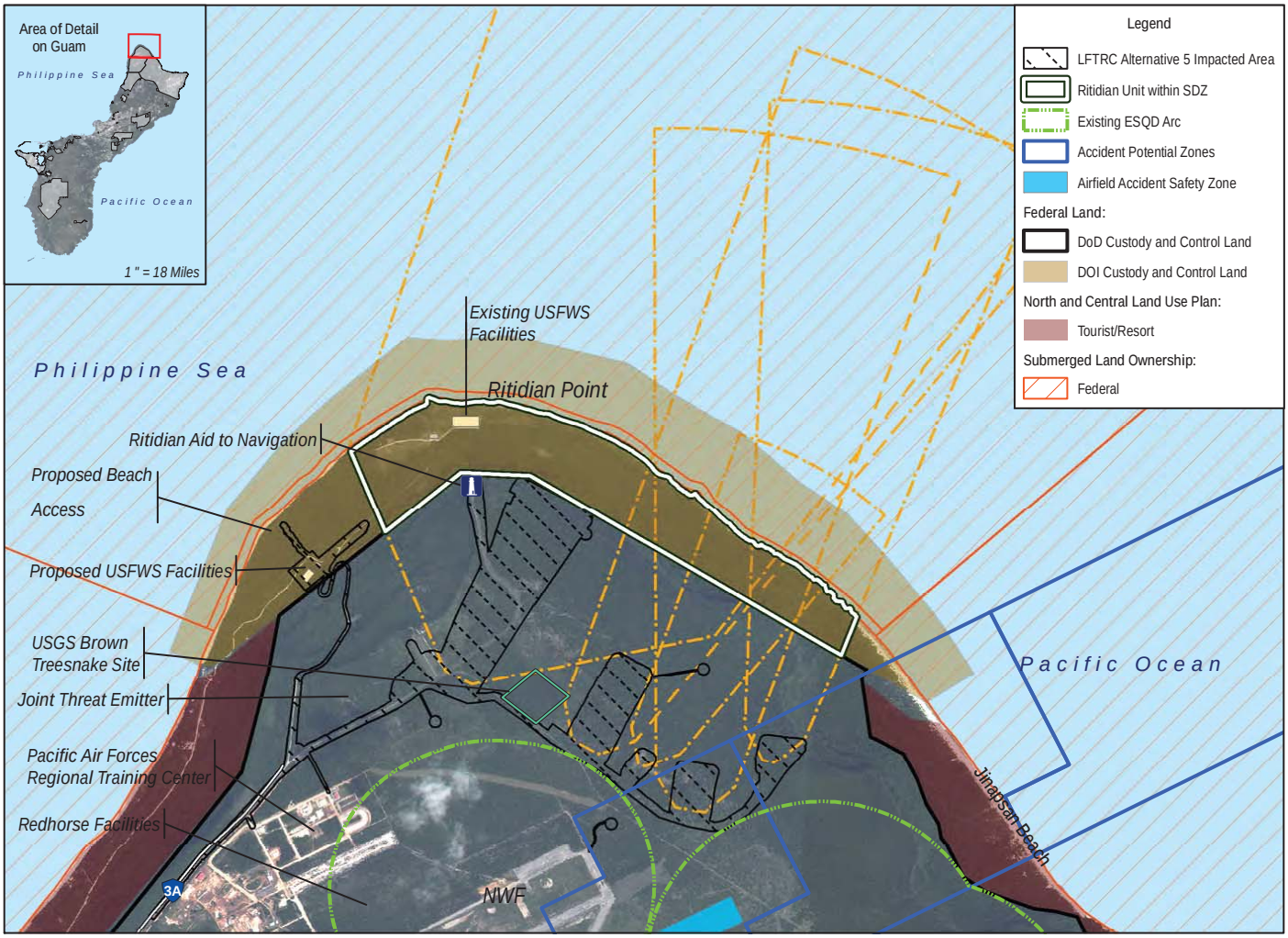


Figure 5.5.6-1
Land Use in the Vicinity of NWF LFTRC Alternative 5

Access to the eastern 46 privately-owned parcels that abut Jinapsan Beach is through AAFB and since the events of 9/11 access has been limited. AAFB issues passes for people and vehicles accessing Jinapsan Beach. Pass holders proceed from AAFB Main Gate to Tarague Beach, where they can park their cars and continue on foot or via sand/gravel road to their property. Part of the site was formerly known as Star Sand Resort and was operated for day-use ecotourism, but AAFB support for this ended after 9/11. The access issue for private landowners at Jinapsan Beach and their families has been resolved to the satisfaction of the landowners and AAFB. AAFB rewrote base access procedures in 2009 to facilitate the ability of the affected people to enjoy their property, and a congressional appropriation was applied toward improving the roadway access to the private lands. This work was completed in 2014 and the private property users will continue to access their property through the AAFB Main Gate. There are existing military training noise (Section 5.5.4) and APZ encumbrances on the private properties bordering NWF. There are no permanent residential populations on the private lands. In addition, no off-base utilities or access roads that would require new easements are proposed.

5.5.6.2 Environmental Consequences

Land use impacts are addressed in this section. Land ownership impacts are addressed in Section 5.5.15, Socioeconomics and General Services.

Construction

As previously discussed in Chapter 3, Section 3.6.3.1, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource under any of the alternatives.

Operation

Although Air Force stakeholders have raised a number of concerns regarding potential impacts to ongoing military training activities at NWF, any potential impacts to ongoing military training activities at NWF would be resolved through the installation planning process for implementing the proposed action, and long-term land use impacts would be less than significant. For example, during preliminary facility planning for Alternative 5, the DON adjusted the range layout to unencumber the Joint Threat Emitter and thereby eliminate the need to relocate that facility. Other potential mission impacts associated with the NWF location (e.g., airspace impacts around active runways at AAFB or the expeditionary runway at NWF, and the PRTC) are the subject of ongoing discussions between Air Force, Navy, and Marine Corps planners. For example, the Commanders of Pacific Air Forces and Marine Forces Pacific have agreed to a memorandum of agreement detailing specific mitigation measures.

Although the federal government already controls the submerged land area within the SDZ footprint, the public is allowed access most of the year. The training schedule at the LFTRC would prohibit public access to federal submerged land, representing a new long-term restriction on public access. The submerged lands are valued for recreational activities and access to important fishing sites, as described in Section 5.5.7, Recreational Resources. The restricted submerged land areas would be noted on navigation maps. The public would be allowed to access the submerged lands north of NWF when the LFTRC is not in use; however, the area would be restricted when the ranges are in use. Such restrictions would be limited to the minimum SDZ area and period of use required for the LFTRC. The DoD would also consider requests for special events, on a case-by-case basis. As described in Section 3.6.3, Approach to Analysis, new access restrictions placed on non-DoD populations is a potentially significant adverse impact.

The USFWS recommended eliminating Alternative 5 during the NEPA scoping period, and one of the reasons provided was that the access restrictions could compromise the ability of USFWS to carry out critical conservation and education actions specific to the Ritidian Unit of the Guam NWR. Subsequently, Section 2822 of the FY 2015 NDAA authorizes the Secretary of the Navy and the Secretary of the Interior to enter into an agreement which would provide for the establishment and operation of an SDZ which overlays the Ritidian Unit or a portion thereof in order to accommodate operation of the LFTRC preferred alternative at NWF by the DON and the continued management of the Ritidian Unit by the USFWS. Section 2822 requires that the agreement shall include measures to maintain the purposes of the Ritidian Unit. Therefore, current conservation land uses would continue within the SDZs. There would be no significant impact on the land use.

There would be new access restrictions imposed for areas within the SDZs for safety reasons. There would be a direct and long-term impact associated with the decrease in access to the Ritidian Unit of the Guam NWR encumbered by the SDZs when the ranges are in use. The agreement negotiated under the authority of Section 2822 of the FY 2015 NDAA will address any access restrictions to the Ritidian Unit, including development of procedures to allow sufficient access to ensure management, use, and enjoyment of the Ritidian Unit consistent with its purposes.

The Ritidian Aid to Navigation (see Figure 5.5.6-1) is located within the SDZ; however, there would be no impact on its maintenance or operation.

As proposed and analyzed in this SEIS, the USFWS facilities within the Ritidian Unit and associated access roads would be relocated. No significant land use impacts would be associated with this relocation. Any decisions regarding the relocation of the USFWS facilities and/or construction to improve beach access at the Ritidian Unit of the Guam NWR are dependent upon the outcome of consultations under section 7 of the ESA and negotiation of the agreement authorized by Section 2822 of the FY 2015 NDAA.

Route 3A would continue to be used to access the proposed relocated USFWS facilities and the private property along the western coast. The proposed action would improve portions of the deteriorated Route 3A. There would be no adverse impact on access to the private lands located west of Route 3A. The portion of the access road to the existing USFWS facilities that is within the SDZ would not be accessible to the public when the ranges are in use. An existing road outside the SDZ and north of the proposed USFWS replacement facilities would be improved to provide alternate public access to Ritidian Beach (see Figure 5.5.6-1). Any decisions regarding the relocation of the USFWS facilities and/or contruction to improve beach access at the Ritidian Unit of the Guam NWR are dependent upon the outcome of consultations under section 7 of the ESA and negotiation of the agreement authorized by Section 2822 of the FY 2015 NDAA.

The Zone 3 noise contour would not extend beyond federal property. Zone 2 noise contours would extend to private lands on the east, as described in the Section 5.5.4.2, Noise and shown on Figure 5.5.4-1. However, no existing or planned residential use (or other sensitive receptors like schools or medical facilities) was identified within the Zone 2 contours. There would be no significant impact to current or planned private land use east of the SDZ due to noise.

The private lands and relocated USFWS buildings to the west/southwest of NWF would be outside of the Zone 2 noise contour. The private land is designated Tourist/Resort. There would be no significant impact to current or planned land uses due to noise. Any decision regarding the relocation of the USFWS facilities is dependent upon the outcome of consultations under section 7 of the ESA and negotiation of the agreement authorized by Section 2822 of the FY 2015 NDAA.

Significant mitigable impacts were identified for Alternatives 1, 2, 4 and 5. Alternative 5 would have a greater impact to land use resources than Alternative 3, which would have no impact.

5.5.7 Recreational Resources

5.5.7.1 Affected Environment

A list of recreational resources at NWF is contained in the 2010 Final EIS (Volume 2, Chapter 9: Recreational Resources, Section 9.1.2.1: Andersen AFB, pages 9-1 to 9-3). Comprehensive descriptions of recreational resources near NWF are contained in the 2010 Final EIS (Volume 9, Appendix G, Chapter 1: Recreational Resources, Section 1.2.1: Andersen AFB and Section 1.2.3: Non-DoD Lands, pages G-1-1 to G-1-5). Table 5.5.7-1 identifies the recreational resources near Alternative 5.

Table 5.5.7-1. Recreational Resources within the Vicinity of Alternative 5

Recreational Resource	*Public Access*
Beaches (Tarague Basin)	
Tarague Beach, Sirena Beach, Scout Beach	Installation personnel and guests only
Picnic Sites	
Picnic Sites (Family and Individuals)	Installation personnel and guests only Limited picnic sites open to the public in Ritidian Unit of Guam NWR
Picnic Sites (Large Groups >20)	Installation personnel and guests only
Camping Area (Tarague Basin)	
Tarague Beach Campsites; Sirena Beach	Installation personnel and guests only
Scout Beach Campsites	Area open only to scouting groups
SCUBA Diving and Swimming Water Sports	
Tarague Beach and Sirena Beach SCUBA Diving and Swimming	Installation personnel and guests only (shoreline access for swimming only; no shoreline access for SCUBA diving; boat access to dive sites only)
Pati Point	Public boat access to dive site only, beyond the reef margin
Hunting	
Game Hunting (Feral Pigs and Deer)	Installation personnel and guests only, and limited to archery only in the area south of NWF.
Fishing (Shoreline Pole and Line)	
Guam NWR Overlay	Installation personnel and guests only (or by special permit)
Ritidian Unit of Guam NWR	Open to the public
AAFB Tarague Basin (Tarague Beach to Pati Beach, except inside designated swimming areas)	Installation personnel and guests only
Fishing (Offshore)	
Rota Banks	Open to the public
45 Bank	Open to the public
Ritidian Point	Open to the public
Pati Point	Open to the public
Anao Point	Open to the public
Nature Activities	
Hiking Trails	Installation personnel and guests only Open to the public in Ritidian Unit of Guam NWR
Scenic Drives/Overlooks	
Tarague Beach Road; Ritidian Point Overlook	Open to the public at Ritidian Unit of Guam NWR; Installation personnel and guests only

Recreational Resource	*Public Access*
Nature Interpretive Centers	
USFWS Nature Center at Ritidian Unit	Open to the public
Natural Areas	
Guam NWR Overlay	Installation personnel and guests only
Ritidian Unit of Guam NWR	Open to the public
Pati Point Natural Area	Installation personnel and guests only

Source: DON 2010.

For this SEIS, the uses and geographical areas of proposed development at AAFB are modified from the above-referenced section of the 2010 Final EIS. As described in Chapter 2 of this SEIS, Alternative 5 proposes using the NWF area of AAFB as a LFTRC. Figure 2.5-6 shows the SDZ for each individual range in the proposed LFTRC. The SDZs would extend over ocean and shoreline recreational resources in a northern direction.

As described in the 2009 Guam NWR Comprehensive Conservation Plan, the Ritidian Unit of the Guam NWR provides recreational opportunities in the form of a nature center, wildlife observation, cave and forest tours, limited boat fishing, cultural resource interpretation, and environmental education. Public recreational activities are permitted on approximately 120 acres (48 ha) west of the USFWS facilities. Additionally, the public may picnic, swim, snorkel, scuba dive, and hike in open portions of the Ritidian Unit.

Since 2003, over 18,000 people have visited the refuge for recreational fishing. Offshore fishing areas in the vicinity include Rota Banks, 45 Bank, Ritidian Point. Additionally, there are Fish Aggregating Devices located north of Ritidian Point (see Figure 3.6.1-1). The SDZ area that extends over the water at Ritidian Point is typically fished during the season when seas are calm enough for small boats, with the majority of fishing occurring during the summer months. Of the recorded fishing trips, approximately 65% occur on the weekends (GDAWR 2014).

The Ritidian Unit and associated Nature Center provide environmental education programs to Guam's students. Between 1998 and 2012, nearly 97,000 elementary and middle school students visited the refuge on school field trips. Since 2003, over 53,000 high school and college students have visited the refuge on school field trips or for volunteer activities. The Nature Center is open 7 days a week, from 8:30 a.m. to 4:00 p.m., and the admission is free. It is estimated that approximately 20 people visit the nature center daily (USFWS 2009). Within the Ritidian Unit, there are 17 parking areas and up to 18 picnic sites for day visitors to the public facilities.

5.5.7.2 Environmental Consequences

Construction

Under Alternative 5, the Guam NWR Nature Center at Ritidian Point would be replaced at a location outside the SDZs prior to operation of the LFTRC, as shown in Figure 2.5-6. The existing center would be utilized until the new center becomes operational. This would ensure uninterrupted visitor use of the center during the construction period, and yield no direct or indirect adverse impacts to recreational resources. Any decision regarding the relocation of the USFWS facilities is dependent upon the outcome of consultations under section 7 of the ESA and negotiation of the agreement authorized by Section 2822 of the FY 2015 NDAA. However, construction-related vehicles travelling along Route 3A would potentially cause a less than significant adverse impact due to traffic congestion and delays to persons attempting to gain access to the Ritidian Unit.

Operation

Proposed activities near NWF assessed in the 2010 Final EIS were limited to land-based training and operation of various aircraft at NWF. Public access is currently permitted to the Ritidian Unit of the Guam NWR and to the associated Ritidian Beach, as well as the private beach dwellings at Urunao Beach. The area to the east of the USFWS facilities is currently closed to the public. Access is also currently limited on the northern portion of the beach due to sea turtle nesting. The SDZs would extend over a portion of the Guam NWR, including onshore and offshore areas. Access to these areas could be restricted during operation of the LFTRC depending upon which ranges and which caliber of weapons are in use at any given time. The agreement negotiated under the authority of Section 2822 of the FY 2015 NDAA would address any access restrictions, including development of procedures to allow sufficient access to ensure management, use, and enjoyment of the Ritidian Unit consistent with its purposes.

Implementation of Alternative 5 would result in direct impacts to recreational resources in the area when ranges are in use. Among the ranges within the LFTRC, the MPMG Range has the largest SDZ and is the only SDZ that would preclude access to a portion of the publicly accessible areas of the Ritidian Unit of the Guam NWR. When any combination of the other ranges not including the MPMG Range are in use, their SDZs would not restrict access to the publicly accessible portion of the Ritidian Unit. Access within the MPMG Range SDZ would be restricted during MPMG Range operational periods. Recreational resources within the MPMG range SDZ include a portion of existing hiking trails leading to caves containing unique ancient Chamorro paintings. The trails and caves that would fall within the MPMG Range SDZ are currently open for access during normal Refuge hours. Impacts of loss of access to the portion of the Ritidian Unit trails, caves and other cultural resources that would fall within the MPMG Range SDZ while it is operational would be significant.

An existing road outside the SDZ and north of the proposed relocation of the USFWS facilities would be improved to provide alternate public access to Ritidian Beach to minimize the impact of access restrictions when the MPMG Range is in use. Areas that would be accessible via the new access route include portions of the existing beach road, beach, cultural features, and trails located outside the MPMG Range SDZ. Two caves would remain outside the MPMG range SDZ and would continue to be accessible via the new access route. MPMG range operations would typically occur during weekdays, which would minimize impacts. Any decision regarding the relocation of the USFWS facilities and/or construction to improve beach access at the Ritidian Unit of the Guam NWR are dependent upon the outcome of consultations under section 7 of the ESA and negotiation of the agreement authorized by Section 2822 of the FY 2015 NDAA.

Although the Alternative 5 LFTRC SDZs would not encompass Rota Bank or Fish Aggregating Devices as shown on Figure 3.6.1-1, there would be loss of access to areas relevant to recreational boaters and fishermen. Offshore fishing areas located within the LFTRC SDZs would be inaccessible during associated range use. When the associated range is in use, boaters would need to either transit around the active SDZs or coordinate with range control to determine when it is safe to transit through the SDZs.

Recreational boating and fishing would be permitted within the SDZs when live-fire training is not being conducted at the range.

As stated in Section 5.5.7.1, approximately 65% of fishing trips occur on the weekends and 35% of fishing trips occur on weekdays. As stated in Section 2.2.3, training at the LFTRC would typically occur on weekdays, but periodic weekend use could occur as needed. To provide awareness of times that the range is in use, the DON would provide the proposed training schedule to the U.S. Coast Guard, who would issue and broadcast a Notice to Mariners that would identify the location of the SDZs and direct

vessel operators to navigate clear of the active SDZs. Additionally, boaters and fishermen would be able to contact range control via radio or phone to get real time updates of active ranges, which would minimize impacts. This communication would allow boaters to transit SDZs during scheduled training days when the ranges are temporarily inactive. Range lookouts would scan the SDZs prior to and during live-fire training to ensure that there are no vessels within or approaching the SDZs. If vessels are at risk of entering an SDZ, use of the range would be suspended until the vessel leaves the SDZ area. Based on the considerations described above, Alternative 5 would result in less than significant impacts to recreational boating and fishing during operation.

As shown in Figure 5.5.4-1, noise impacts above 65 ADNL (the level at which noise is considered incompatible with noise-sensitive land uses) are almost entirely within the SDZ. Since the SDZ is closed to the public during training events (i.e., noise-producing events), there would be no impact to people seeking recreation. The new USFWS Nature Center would be located outside of the SDZ. Noise during training events would be between 55 and 64 ADNL at the relocated Nature Center and nearby beach. This noise level is considered compatible with most land uses; however, the additional noise could lessen visitor enjoyment. Because noise levels would be compatible with the recreational land use, noise impacts to recreational resources would be less than significant.

5.5.8 Terrestrial Biological Resources

5.5.8.1 Affected Environment

Vegetation Communities

Figure 5.5.8-1 depicts the vegetation communities associated with the NWF LFTRC. The vegetation communities were mapped based on the following sources:

- AAFB (2008a) - base-wide mapping.
- Field surveys conducted in 2012 (NAVFAC Pacific 2013a).
- 2011 aerial imagery - review of that imagery showed some recently developed land.

Vegetation types are described in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.1.1: pages 10-1 to 10-6). Portions of the NWF area were evaluated during surveys in 2012 (NAVFAC Pacific 2013b) to determine if there had been any changes to vegetation communities since the AAFB (2008a) basewide mapping effort. Based on the 2012 surveys, vegetation mapping has been revised to account for several areas that have been cleared since the 2008 mapping. No other changes were made to the 2008 mapping within the impacted areas shown in Figure 5.5.8-1.

The majority of the area that would be potentially impacted under Alternative 5 is primary and secondary limestone forest (Figure 5.5.8-1). The north end of the proposed MPMG Range from approximately the footprint of the range to the northern limits of the impacted area consists of highly weathered, rugged karst limestone terrain characterized by sharp pinnacles and towers and deep, narrow fissures that support a primary limestone vegetation community. Primary limestone forest in this area is generally less disturbed by ungulates, particularly feral pigs.

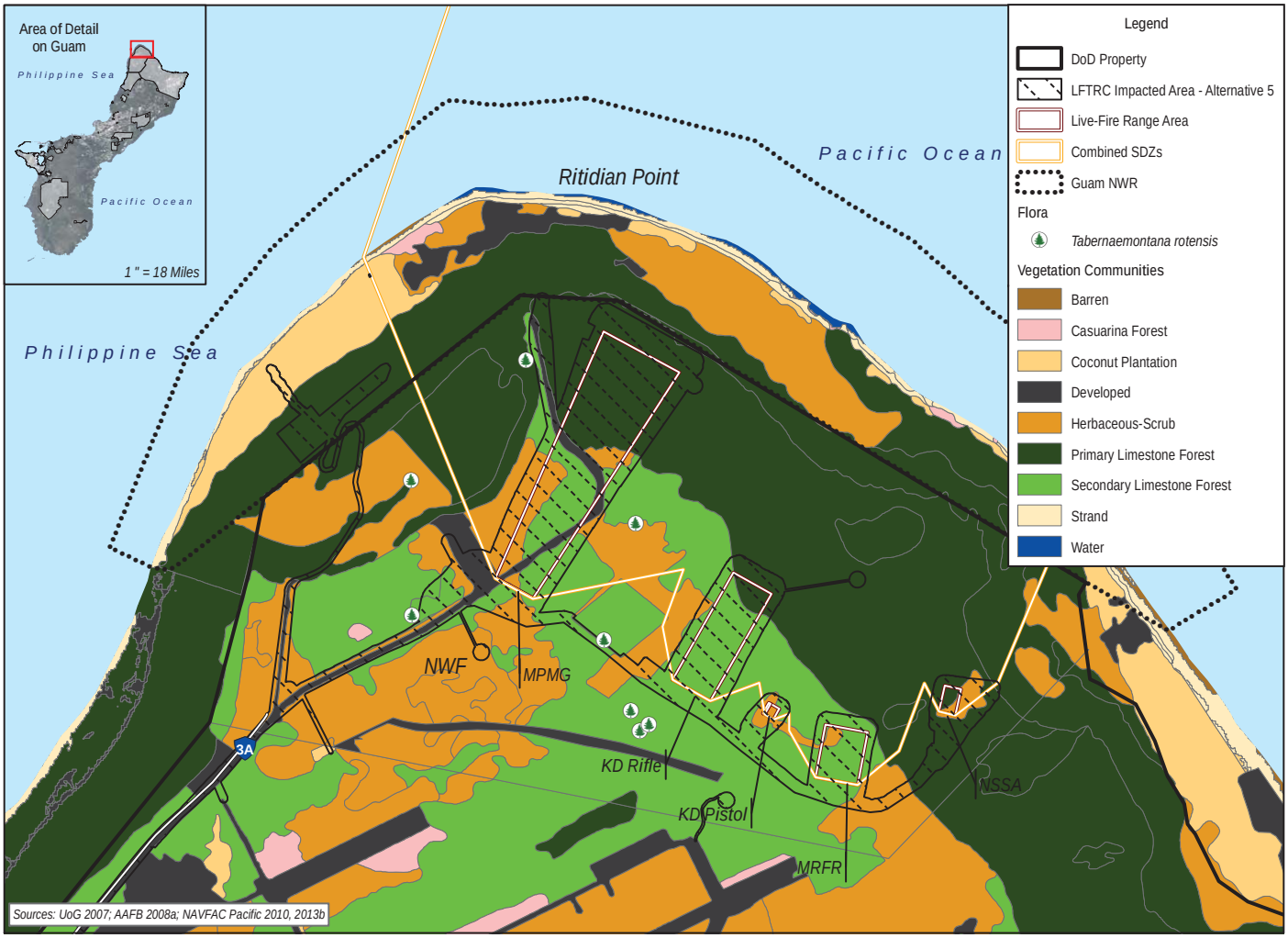


Figure 5.5.8-1
Vegetation Communities and Plant SOGCN Observations - NWF LFTRC Alternative

Terrestrial Conservation Areas

All of the area associated with construction of the ranges under Alternative 5 is within established Overlay Refuge (Figure 5.5.8-2). Additional information on Overlay Refuge lands is provided in Section 3.8.1.2 of this SEIS and the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.1.3: Special-Status Species, pages 10-8 to 10-9). Immediately north of AAFB is the Ritidian Unit of the Guam NWR. See Section 5.5.6, *Land and Submerged Land Use* for a detailed discussion of the NWR. In addition, the terrestrial portion of the Ritidian Unit of the Guam NWR is also designated critical habitat, which is discussed below under *Special-Status Species: Federal ESA-Listed and Proposed Species and Designated Critical Habitat*.

Several areas have been created on AAFB for scientific research or as conservation measures for previous environmental impacts and as required in USFWS BOs issued under the ESA. In accordance with a BO for previous Air Force actions on AAFB (USFWS 2006b), an ungulate exclosure has been constructed within the proposed LFTRC (Figure 5.5.8-2).

Wildlife - Native Species

During detailed surveys of migratory birds within open habitats on AAFB in 2011, 997 individuals of 9 species were observed (NAVFAC Marianas 2013). Six species were identified in short-grass habitat with Pacific golden plover being the most commonly observed followed by the ruddy turnstone. Other species observed included wood sandpiper, wandering tattler, gray-tailed tattler, sharp-tailed sandpiper, Pacific reef heron, whimbrel, and ruff. Surveys for forest birds in 2012 at four locations in the proposed NWF LFTRC area did not detect any native birds (NAVFAC Pacific 2013b). Other native species observed on AAFB in past studies, as described in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: page 10-22), include yellow bittern, fairy tern, barn swallow, and fork-tailed swift (NAVFAC Pacific 2010).

Non-listed native reptiles observed at AAFB in the NWF area include the blue-tailed skink and mutilating gecko (NAVFAC Pacific 2010). The 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: Andersen AFB, page 10-22) also lists and provides information about other native wildlife species present on AAFB including the coconut crab and butterflies. Several coconut crabs were observed during 2012 surveys in the NWF area (NAVFAC Pacific 2013b).

Non-native species of birds, mammals, reptiles, amphibians, and invertebrates present at AAFB, including the NWF area, are described in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: Andersen AFB, pages 10-23 to 10-24).

Special-Status Species: Federal ESA-Listed and Proposed Species and Designated Critical Habitat

Four ESA-listed (Mariana fruit bat, green and hawksbill turtles, *Serianthes nelsonii*) and four proposed species (Mariana eight-spot butterfly, *Tabernaemontana rotensis, Bulbophyllum guamense, and Psychotria malaspinae*) occur on AAFB within the Alternative 5 action area (Table 5.5.8-1 and Figure 5.5.8-3). Although "suitable habitat" for special-status species is present within the Alternative 5 project areas, the brown treesnake, the primary factor in the extirpation of special-status wildlife species on Guam and one of the largest obstacles to achieving recovery of special-status species, is still considered abundant and widespread on Guam. Until brown treesnakes are suppressed or removed from at least targeted areas on Guam, the habitat is not in a suitable condition to support the survival of special-status species due to current snake abundance on Guam (e.g., Guam Micronesian kingfisher, Guam rail, Mariana crow) (USFWS 2010a).

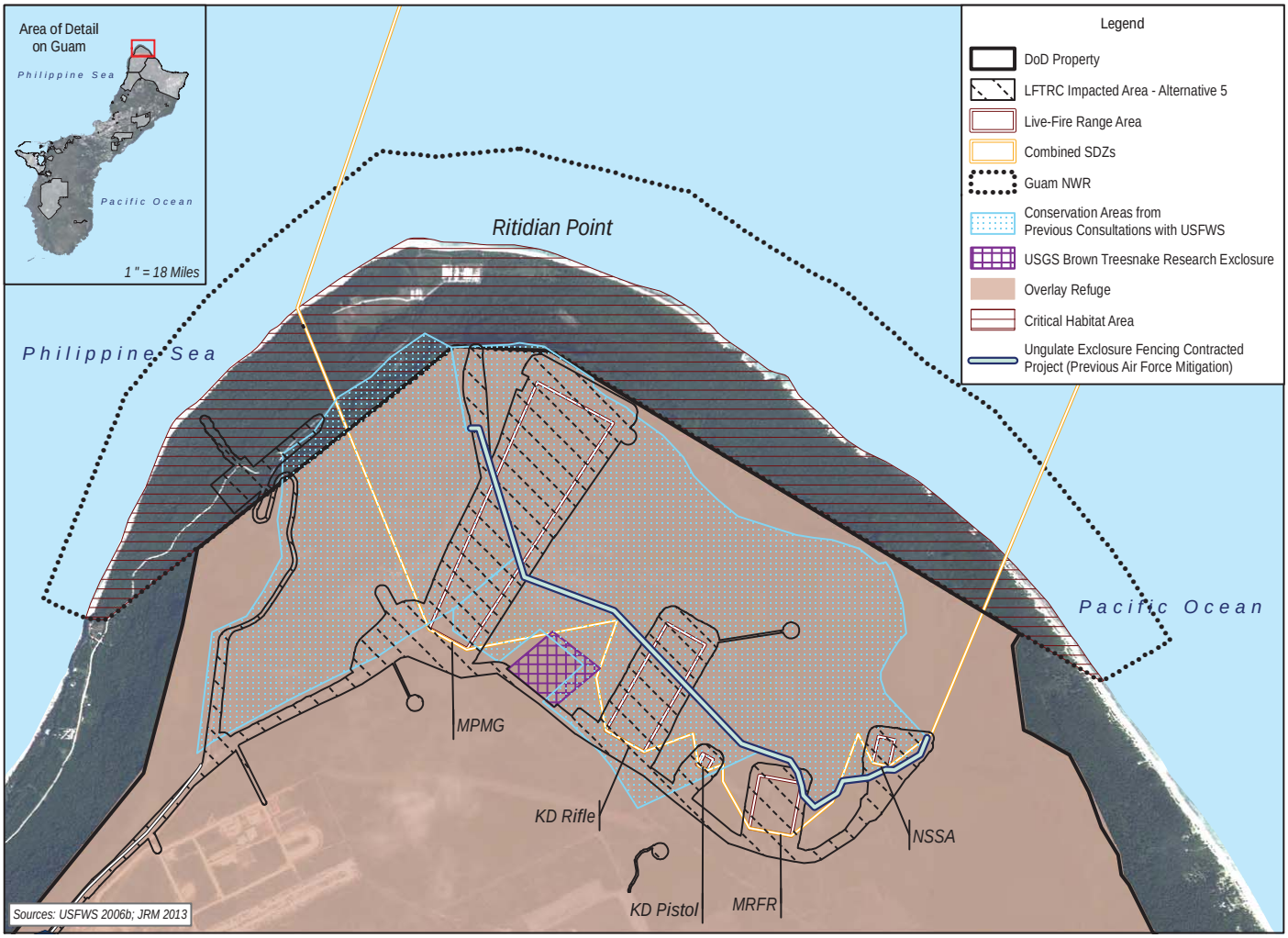


Figure 5.5.8-2
Terrestrial Conservations Areas within the Vicinity of the NWF LFTRC Alternative

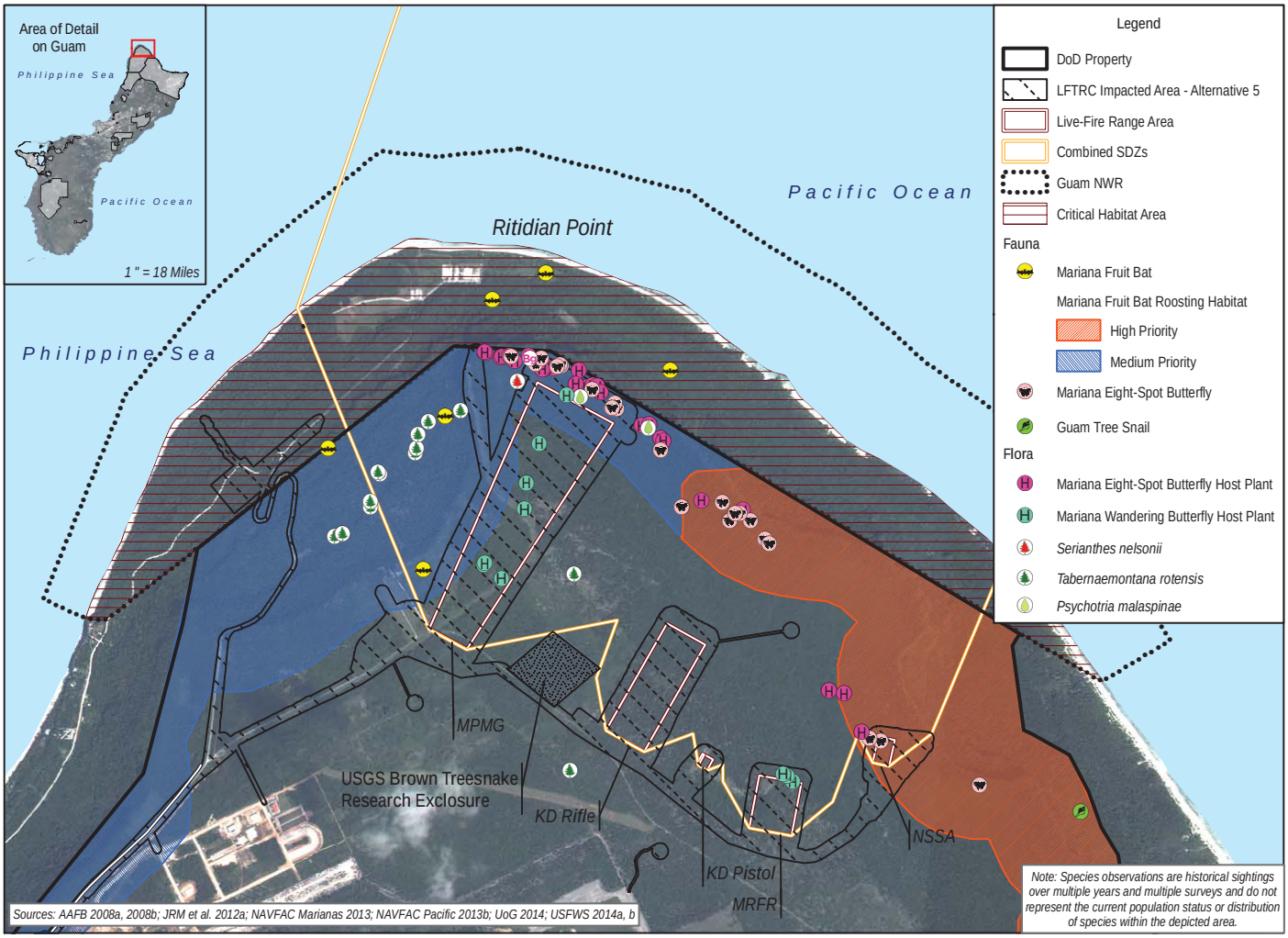


Figure 5.5.8-3
Special-Status Species Observations - NWF LFTRC Alternative

In addition to the discussion below, additional information for individual species at AAFB NWF was provided in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.1.3.1: Andersen AFB, pages 10-24 to 10-33).

MARIANA FRUIT BAT. Recent fruit bat observations on AAFB were of flying and (in a few cases) roosting individuals and were most commonly observed in three general regions on AAFB: the cliffline extending from above the CATM Range east to Pati Point; in or near the MSA; and in the vicinity of the HMU (see Figure 4.1.8-5) (JRM *et al.* 2012a). There have been only three fruit bat observations within the Alternative 5 action area on AAFB since 2005 (Janeke 2006b as cited in AAFB 2008b; JRM *et al.* 2012b, 2012c, 2012d). From 2010 through November 2013, there have been five reports of one to three fruit bats in flight at the Ritidian Unit of the Guam NWR. Guam NWR personnel believe that fruit bats may roost near Star Cave at Ritidian Point on NWR property (Personal communication via email from Jennifer Cruce, Guam NWR to Anne Brooke, JRM, November 7, 2013). High and medium priority fruit bat roosting habitat as defined in the AAFB *Mariana Fruit Bat Management Plan* (AAFB 2008b) are found within the action area (see Figure 5.5.8-3). These areas were identified based on historical colony roost locations and current habitat conditions on AAFB.

Fruit bat recovery habitat was described by the USFWS in the BO for the Guam and CNMI Military Relocation (USFWS 2010a) and includes the following vegetation types (based on vegetation mapping by the USFS [2006]) for foraging, roosting, and breeding: limestone forest, coconut plantation, ravine forest, and groves of *Casuarina equisetifolia*. Fruit bat recovery habitat is found within proposed project impacted areas associated with Alternative 5 (see Figure 3.8.3-1).

Table 5.5.8-1. Distribution of Special-Status Species on AAFB Associated with the NWF LFTRC Alternative

Name	*Status*		*Habitat*	*Known to Occur†*	*Comments*
	ESA[(d)]	*Guam[(j)]*			
Mammals					
Mariana fruit bat[(a, c, d, h, j, o, p, v)]	T	E	Limestone forest, coastal forest, and coconut plantations.	Yes	Last observation in action area in 2011; few individuals occur throughout AAFB; no known colonial roost sites; recovery habitat present.
Birds					
Mariana swiftlet[(a, d, h, j)]	E	E	Limestone cliffs with caves for roosting and nesting; forages over forest and grasslands.	No	NR; One nest/roost cave at Ritidian Point that was abandoned in late 1970s.
Mariana crow[(a, d, h, p, s, v)]	E	E	All forests with a preference for native limestone forest.	No	Extirpated from Guam – last seen on AAFB in 2012; suitable habitat present on AAFB; recovery habitat present.
Guam Micronesian kingfisher[(a, d, h, t, v)]	E	E	Forest and scrub with a preference for native limestone forest.	No	Extirpated from the wild on Guam by 1988; suitable habitat present on AAFB; recovery habitat present.
Guam rail[(a, d, h, u, v)]	E	E	Secondary habitats, some use of savanna and limestone forests.	No	Extirpated from the wild on Guam by 1985; suitable habitat present on AAFB; recovery habitat present.
Micronesian starling[(a, h, i, j)]	-	E	All habitats but higher density in developed areas.	No	Present in the housing area and flightline; occasionally observed east of the MSA.

Table 5.5.8-1. Distribution of Special-Status Species on AAFB Associated with the NWF LFTRC Alternative

Name	*Status*		*Habitat*	*Known to Occur†*	*Comments*
	ESA[d]	*Guam[j]*			
White-throated ground dove[b, h, j, k]	-	E	Prefers native limestone and ravine forests	No	Rare observations within MSA.
Reptiles					
Green and hawksbill turtles[a, d, h, j]	T	T	Suitable beaches for basking and nesting.	Yes	Nesting beach habitat not within impacted areas; only within SDZs.
	E	E			
Moth skink[h, i, j]	-	E	Forest areas with large tree trunks.	No	NR; none observed in 2012 surveys.
Pacific slender-toed gecko[h, i, j]	-	E	Forest edge.	No	NR; none observed in 2012 surveys.
Slevin's skink[g, w]	PE	E	Mid-elevation closed humid and montane forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Invertebrates					
Mariana eight-spot butterfly[e, g, i, j, l]	PE	-	Intact limestone forest with host plants.	Yes	Host plants, adults, eggs and chrysalis observed in impacted areas during 2012 and 2013 surveys.
Mariana wandering butterfly[l, r]	PE	-	Larvae feed on one known host plant species found in native limestone forest habitat.	No	Has not been seen on Guam since 1979 and considered extirpated; host plants observed within impacted areas.
Guam tree snail[a, h, j, l]	PE	E	Cool shaded forested areas with high humidity.	No	NR; not observed during 2013 surveys of impacted areas.
Humped tree snail[a, h, j, l]					
Fragile tree snail[a, f, h, j, l]					
Plants					
Serianthes tree[a, b, c, d, g, h, j, m, q, v]	E	E	Limestone and ravine forests.	Yes	Known location within impacted areas; recovery habitat present.
Heritiera tree[a, b, g, h, j, q, w]	PE	E	Limestone forest.	No	NR; none observed during 2012 surveys of impacted areas.
Tabernaemontana rotensis[b, g, i, j, n, q, w]	PT	SOGCN	Native limestone forest.	Yes	Known location within vicinity of impacted areas.
Cycas micronesica[b, g, i, q, w]	PE	SOGCN	Limestone areas, ravine forests, and savanna summits.	No	NR; none observed during 2012 surveys of impacted areas.
Bulbophyllum guamense[g, w]	PE	-	Lowland/limestone forests.	Yes	One occurrence along cliffline at northern edge of impacted areas.
Eugenia bryanii[g, w]	PE	-	Windy exposed coastal clifflines in lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Maesa walkeri[g, w]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Nervilia jacksoniae[g, w]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Psychotria malaspinae[g, w]	PE	-	Lowland/limestone forests.	Yes	One occurrence along cliffline at northern edge of impacted areas.
Solanum guamense[g, w]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.

Table 5.5.8-1. Distribution of Special-Status Species on AAFB Associated with the NWF LFTRC Alternative

Name	*Status*		*Habitat*	*Known to Occur†*	*Comments*
	ESA[d]	*Guam[j]*			
Tinospora homosepala[g, w]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Tuberolabium guamense[g, w]	PE	-	Lowland/limestone forests.	No	NR; not observed in 2012 surveys in the impacted areas.
Dendrobium guamense[g, w]	PE	-	Limestone forests	No	NR; not observed in 2012 surveys in the impacted areas.

Legend: - = not listed, E = endangered, NR = not reported, PE = proposed endangered, PT = proposed threatened, T = threatened.
†Occurrence within NWF LFTRC action area.
Sources: [a]Wiles *et al.* 1995; [b]GDAWR 2006; [c]USFWS 2010a; [d]USFWS 2011; [e]USFWS 2012a; [f]USFWS 2012c; [g]NAVFAC Pacific 2013b; [h]GovGuam 2009; [i]NAVFAC Pacific 2010; [j]JRM 2013; [k]NAVFAC Marianas 2013; [l]UoG 2014; [m]USFWS 1994; [n]UoG 2007; [o]JRM *et al.* 2012b, c, d; [p]JRM *et al.* 2012b; [q]AAFB 2008a; [r]USFWS 2013; [s]USFWS 2005; [t]USFWS 2008b; [u]USFWS 2009b, BirdLife International 2013; [v]USFWS 2010b; [w]USFWS 2014a, 2014b.

Mariana Fruit Bat Critical Habitat. Immediately north of the proposed NWF LFTRC below the cliffline is the Ritidian Unit of the Guam NWR (see Figure 5.5.8-3). In 2004, the USFWS designated the 370.6-acre (150-ha) terrestrial portion of the Ritidian Unit of the Guam NWR as critical habitat for the Mariana fruit bat (USFWS 2004a, 2014c). In accordance with the ESA, the designation of critical habitat is based on those physical and biological features that are essential to the conservation of the species and that may require special management considerations or protection. Such features are termed *primary constituent elements* (PCEs) and are those features required by the species for the biological needs of foraging, sheltering, roosting, and rearing of young. The PCEs for the fruit bat are:

- Plant species used for foraging, such as breadfruit, papaya, fadang, fig, kafu, coconut palm, and talisai.
- Remote locations, often within 328 feet (100 m) of clifflines that are 260 - 590 feet (80 - 180 m) tall, with limited exposure to human disturbance and that contain mature fig, chopak, gago, macadamia nut tree, panao, fagot, and other tree species that are used for roosting and reproductive activity (USFWS 2004a).

These PCEs of Mariana fruit bat critical habitat are found in areas supporting primary limestone, secondary limestone, ravine, swamp, coconut palm, and coastal forests composed of native and introduced plant species (USFWS 2004a).

MARIANA SWIFTLET. A nest/roost cave previously used by Mariana swiftlets is known from Ritidian Point, but this cave was abandoned by the late 1970s (USFWS 1991). Biological surveys conducted in 2008 and 2009 in support of the 2010 Final EIS and in 2012 and 2013 in support of this SEIS, did not record any incidental observations of Mariana swiftlets (NAVFAC Pacific 2010, 2013b; UoG 2014). The only known occupied nest/roost caves on Guam are located on the NAVMAG more than 20 miles (32 km) south of the NWF LFTRC action area. As swiftlets forage within 0.6-1.2 miles (1-2 km) of their nest/roost caves (Jenkins 1983), it unlikely that individuals from the only known population on Guam over 20 miles (32 km) away would occur within the NWF LFTRC action area. Therefore, as the Mariana swiftlet is not found within the impacted areas of Alternative 5, this species is not addressed further.

MARIANA CROW. Since 2009, the population of Mariana crows on Guam consisted only of two males on AAFB, occurring primarily within the MSA (USFWS 2009c). However, as of 2012, the Mariana crow is considered extirpated in the wild on Guam (Personal communication via letter from USFWS, Pacific Islands Fish and Wildlife Office, Honolulu, HI regarding the DON NOI for Proposed Placement of

LFTRC on Guam NWR; December 7, 2012). The closest population of crows is on the island of Rota, approximately 56 miles (90 km) north of Guam. Crows in northern Guam used primary limestone forest for nesting, with nests exclusively in native trees. They have been observed foraging in both primary and secondary limestone forests and tangantangan (USFWS 2005). Crow recovery habitat is found within proposed project impacted areas on Finegayan and in support areas on AAFB and adjacent lands (see Figure 3.8.3-1).

Mariana Crow Critical Habitat. In 2004, the USFWS designated 362.8 acres (146.8 ha) terrestrial portion of the Ritidian Unit of the Guam NWR as critical habitat for the Mariana crow (see Figure 5.5.8-2) (USFWS 2004a, 2014c). The PCEs required by the crow for the biological needs of foraging, sheltering, roosting, and rearing of young are:

- Emergent and subcanopy trees with dense cover for breeding such as fagot, pengua, ifit, ahgao, aabang, fig, yoga, and faia.
- Sufficient area of predominantly native limestone forest to allow nesting at least 950 feet (290 m) from the nearest road and 203 feet (62 m) from the nearest forest edge and to support Mariana crow breeding territories (approximately 30-91 acres [12-37 ha]) and foraging areas for nonbreeding juvenile crows.
- Standing dead trees and plant species for foraging, such as mapunao, breadfruit, coconut palm, fagot, pago, ifit, tangantangan, langiti, kafu, ahgao, fig, and yoga (USFWS 2004a).

These PCEs of Mariana crow critical habitat are found in areas supporting limestone, secondary, ravine, swamp, agricultural, and coastal forests composed of native and introduced plant species (USFWS 2004a).

GUAM MICRONESIAN KINGFISHER. The Guam Micronesian kingfisher was extirpated in the wild by 1988 and is now found only in captivity on Guam and at mainland zoos. Kingfishers utilized a wide variety of habitats including primary and secondary limestone forest, strand forest, coconut forest, edge habitats, and forest openings, but mature forests with tree cavities suitable for nesting may be an important requirement for kingfisher reproduction (USFWS 2008b). Kingfisher recovery habitat within the proposed impacted areas of Alternative 5 includes primary and secondary limestone forest, coconut forest, and tangantangan (see Figure 3.8.3-1).

Guam Micronesian Kingfisher Critical Habitat. In 2004, the USFWS designated 362.8 acres (146.8 ha) of the Guam NWR – Ritidian Unit as critical habitat for the Guam Micronesian kingfisher (see Figure 5.5.8-2) (USFWS 2004a, 2014c). The PCEs required by the kingfisher for the biological needs of foraging, sheltering, roosting, and rearing of young are:

- Closed canopy and well-developed understory vegetation; large (minimum of approximately 17 inches [43 cm] diameter at breast height), standing dead trees (especially faniok, umumu, breadfruit, fig, and coconut palm); mud nests of *Nasutitermes* spp. termites; and root masses of epiphytic ferns for breeding.
- Sufficiently diverse structure to provide exposed perches and ground surfaces, leaf litter, and other substrates that support a wide range of vertebrate and invertebrate prey species for foraging kingfishers.
- Sufficient overall breeding and foraging area to support kingfisher territories of approximately 25 acres (10 ha) each (USFWS 2004a).

These PCEs of Guam Micronesian kingfisher critical habitat are found in areas supporting limestone, secondary, ravine, swamp, agricultural, and coastal forests composed of native and introduced plant species (USFWS 2004a).

GUAM RAIL. The Guam rail has been extirpated in the wild on Guam since 1985 and exists primarily in captivity on Guam and in mainland zoos. Experimental populations of Guam rails were introduced onto Rota, CNMI in 1989 and onto Cocos Island, off the southern coast of Guam, in 2011 (USFWS 2009b; BirdLife International 2013). The Guam rail prefers edge habitats, especially grassy or secondary vegetation areas which provide good cover; mature forest is deemed only marginal for the Guam rail (USFWS 2009b). Rail recovery habitat within the impacted areas of Alternative 5 includes secondary limestone forest, herbaceous scrub, coconut forest, and tangantangan (see Figure 3.8.3-2).

SEA TURTLES. Green sea turtle nesting is documented on the Ritidian Unit of the Guam NWR to the north of the proposed impacted areas. The hawksbill sea turtle has not been definitively determined to nest on Guam (JRM 2013). There are no sea turtle nesting beaches within the proposed impacted areas associated with Alternative 5.

SLEVIN'S SKINK. Originally found on Guam, Cocos Island, Rota, Tinian, Guguan, Alamagan, Asuncion, and Maug, it is now limited to Cocos Island, Sarigan, Guguan, Alamagan, Pagan, and Asuncion. Slevin's skink has not been recorded on Guam since 1945 and is believed to be extirpated from Guam; it is now known to occur only on Cocos Island (an atoll south of Guam) (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 5 (USFWS 2014b). Therefore, as Slevin's skink is not found within the impacted areas of Alternative 5, this species is not addressed further.

MARIANA EIGHT-SPOT BUTTERFLY. Surveys conducted in 2012 and 2013 within the Alternative 5 action area have observed eight-spot butterfly adults, eggs, and chrysalis (NAVFAC Marianas 2013; NAVFAC Pacific 2013b; UoG 2014) (see Figure 5.5.8-3). In addition to these observations, extensive host plant patches and five occurrences with adult or larval butterflies were documented during 2012 project-specific surveys in the NWF area (see Figure 5.5.8-3) (NAVFAC Pacific 2013b). All adult and larva observations were near the cliffline in the area of the proposed MPMG Range; host plant patches were present in this area and were also found in other locations.

MARIANA WANDERING BUTTERFLY. The Mariana wandering butterfly has not been seen on Guam since 1979 and considered extirpated; a single remaining population occurs on Rota, CNMI (USFWS 2013). The only species known to be a Mariana wandering butterfly host plant (*Maytenus thompsonii*) is a common shrub of limestone forests on Guam and has been observed within the impacted areas of Alternative 5 (see Figure 5.5.8-3) (Moore and McMakin 2001; UoG 2014).

TREE SNAILS. In surveys conducted in 2011 and 2013, no tree snails were observed in the NWF area (NAVFAC Marianas 2013; UoG 2014). Although tree snails were not found within the impacted areas of Alternative 5, potential tree snail habitat does occur within the impacted areas of Alternative 5.

SERIANTHES TREE. This is a large tree reaching 60 feet (18 m) or more in height, with an average trunk diameter of nearly 6 feet (2 m). It grows along limestone cliffs, usually in primary forest, but Fosberg (1960) reported that it also occurred in low numbers in late successional secondary limestone forest. There is only one remaining mature seed-bearing tree on Guam and it is in the NWF area above Ritidian Point within primary limestone forest (see Figure 5.5.8-3). Two planted *Serianthes* saplings are located in the Tarague Basin area approximately 4 miles (6.4 km) east of the lands considered under this alternative. There were no additional observations of this species during 2012 surveys of the Alternative 5 action area

(NAVFAC Pacific 2013b). *Serianthes* recovery habitat does occur within the impacted areas of AAFB (see Figure 3.8.3-2).

HERITIERA LONGIPETIOLATA. This endemic tree is found on AAFB in crevices of rough limestone in primary limestone forest. A 2007 base-wide survey documented the species as occurring at numerous locations on AAFB, primarily in the central portion of the base, and near the limestone cliffs in the northeast and southeast corners (UoG 2007) (see Figure 4.1.8-5). In addition, no *H. longipetiolata* were observed during surveys of the action area in 2010, 2012, and 2013 (NAVFAC Pacific 2010, 2013b; UoG 2014). There are no records of the species within the impacted areas of AAFB (USFWS 2014b). Therefore, as *H. longipetiolata* is not found within the impacted areas of Alternative 5, this species is not addressed further.

TABERNAEMONTANA ROTENSIS. The distribution of this species was evaluated on AAFB in 2007 (UoG 2007). Over 21,000 *T. rotensis* individuals were found throughout AAFB at 265 mapped locations, primarily in the central portion of the base and near the limestone cliffs in the northeast (see Figure 4.1.8-2). In addition, no *T. rotensis* were observed during surveys of the action area in 2010, 2012, and 2013 (AAFB 2008a; NAVFAC Pacific 2010, 2013b; UoG 2007, 2014). There are no records of the species within the impacted areas of AAFB (USFWS 2014b). Therefore, as *T. rotensis* is not found within the impacted areas of Alternative 5, this species is not addressed further.

CYCAS MICRONESICA. This species is abundant in many areas on AAFB, particularly in primary limestone forest habitat. Recent surveys within the Alternative 5 action area found numerous individuals that were in fair or poor condition due to the Asian cycad scale (NAVFAC Pacific 2013b; UoG 2014). There are no records of the species within the impacted areas of AAFB (USFWS 2014b). Therefore, as *C. micronesica* is not found within the impacted areas of Alternative 5, this species is not addressed further.

BULBOPHYLLUM GUAMENSE. An epiphyte in the orchid family, this species occurs in mat-like formations on tree branches of coastal lowland/limestone forests. Currently, there are 8 known occurrences on Guam totaling fewer than 250 individuals. There is 1 occurrence within the northern edge of impacted area of Alternative 5 along the cliffline (Figure 5.5.8-3) (USFWS 2014a, 2014b).

EUGENIA BRYANII. A perennial shrub in the myrtle family, the species is known only from the island of Guam. Historically, *E. bryanii* is known from windy exposed coastal clifflines and along the Pigua River, in lowland/limestone forests. Currently, *E. bryanii* is known from 6 occurrences totaling fewer than 420 individuals (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 5 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *E. bryanii* is not found within the impacted areas of Alternative 5, this species is not addressed further.

MAESA WALKERI. A shrub or small tree in the primrose family typically found in limestone forests, this species is known from only 2 individuals on Guam (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 5 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *M. walkeri* is not found within the impacted areas of Alternative 5, this species is not addressed further.

NERVILIA JACKSONIAE. A small herb in the orchid family, this species is found in lowland/limestone forests. On Guam, *N. jacksoniae* is known from 2 occurrences totaling fewer than 200 individuals (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 5 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *N. jacksoniae* is not found within the impacted areas of Alternative 5, this species is not addressed further.

PSYCHOTRIA MALASPINAE. A shrub or small tree in the coffee family, this species is found in lowland/limestone forests. Currently, *P. malaspinae* is known from 3 occurrences: 1 individual at Ritidian Point within the Guam NWR, 1 individual at Pågat Point, one individual at the base of Mt. Almagosa, and 2 individuals at NWF (USFWS 2014a, 2014b). None of these individuals have been observed within the last 5 years. A specimen collected from Ritidian Point in August 2013 is currently pending identification (USFWS 2014a). There is one record of an individual within the impacted area of Alternative 5 (Figure 5.5.8-3) (USFWS 2014b).

SOLANUM GUAMENSE. A small shrub in the nightshade family that occurs within limestone forests. Currently, *S. guamense* is known from a single occurrence of 1 individual on Guam (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 5 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *S. guamense* is not found within the impacted areas of Alternative 5, this species is not addressed further.

TINOSPORA HOMOSEPALA. A vine in the moonseed family found in limestone forests. Currently, *T. homosepala* is known from 3 occurrences totaling approximately 300 individuals (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 5 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *T. homosepala* is not found within the impacted areas of Alternative 5, this species is not addressed further.

TUBEROLABIUM GUAMENSE. An epiphyte in the orchid family found in limestone forests. Currently, *T. guamense* is known from 3 occurrences on Guam: 2 occurrences within the NAVMAG and one occurrence within Finegayan (NAVFAC Pacific 2010; USFWS 2014a, 2014b). There are no records of the species within the impacted areas of Alternative 5 (NAVFAC Pacific 2010, 2013a, 2013b; USFWS 2014a, 2014b). Therefore, as *T. guamense* is not found within the impacted areas of Alternative 4, this species is not addressed further.

DENDROBIUM GUAMENSE. An epiphyte in the orchid family, the species occurs within lowland/limestone forests and savanna. On Guam, there are 4 occurrences totaling fewer than 250 individuals (USFWS 2014a). There are no records of the species within the impacted areas of Alternative 5 (USFWS 2014b). Therefore, as *D. guamense* is not found within the impacted areas of Alternative 5, this species is not addressed further.

Special-Status Species: Guam-Listed Species and SOGCN

Two Guam-listed endangered species (Micronesian starling white-throated ground dove) occur on AAFB within the Alternative 5 action area (see Table 5.5.8-1). Species that are both Guam-listed and federally listed were discussed above.

MICRONESIAN STARLING. As described in Section 4.3.8.1, the starling is present in the housing area at AAFB (JRM 2013; J. Savidge, Colorado State University, personal communication to G. Metzler, Cardno TEC, May 23, 2013) and has also been observed occasionally throughout AAFB, primarily east of the MSA (NAVFAC Pacific 2010; JRM *et al.* 2012d; JRM 2013) (see Figure 4.1.8-5). The starling has not been observed at NWF or the impacted areas during numerous past and recent surveys conducted within the area (NAVFAC Pacific 2010, 2013b; JRM *et al.* 2012b, 2012c, 2012d; JRM 2013). On Guam, it is also present on Cocos Island, parts of Hagåtña, and the southeastern beach strand areas (JRM 2013). Even though the Micronesian starling has not been recently documented within the impacted areas of the Alternative 5, sightings of this species elsewhere on AAFB suggest habitat utilization may potentially occur within NWF action area.

WHITE-THROATED GROUND DOVE. Although the white-throated ground dove is considered extirpated from Guam due to the brown treesnake (GDAWR 2006), it is seen on very rare occasions on AAFB, primarily within the MSA and the southeastern corner of the base (JRM *et al.* 2012a, 2012b; NAVFAC Marianas 2013; UoG 2014). Observed individuals are thought to be transients from Rota (GDAWR 2006; NAVFAC Marianas 2013) and a resident or breeding population does not occur on Guam. The white-throated ground dove was not seen or heard during surveys of the action area in 2009, 2012, and 2013 (NAVFAC Pacific 2010, 2013a, 2013b; UoG 2014). Therefore, as the white-throated ground dove is not found within the impacted areas of Alternative 5, this species are not addressed further.

MOTH SKINK AND PACIFIC SLENDER-TOED GECKO. The moth skink and Pacific slender-toed gecko are listed by Guam as endangered. These species are threatened primarily by introduced species (e.g., feral ungulates, curious skinks, musk shrews, rats, brown treesnakes, and feral cats) and loss of limestone forest habitat. Although both species have been observed within AAFB, neither were observed during 2009 and 2012 surveys of the Alternative 5 action area (NAVFAC Pacific 2010, 2013b).

5.5.8.2 Environmental Consequences

Construction

Vegetation. Impacts to vegetation from the construction of the HG Range at Andersen South were discussed in Section 5.1.8.2 and there would be less than significant impacts. The following analysis focuses on the proposed range facilities at NWF.

Under Alternative 5, 89 acres (36 ha) of primary limestone forest and 111 acres (45 ha) of secondary limestone forest would be impacted during proposed construction activities at NWF (Table 5.5.8-2 and see Figure 5.5.8-1). In addition, 63 acres (26 ha) of currently developed areas would be impacted as well as 53 acres (20 ha) of herbaceous scrub/grassland and coconut plantation that are of less importance as habitat for most wildlife and special-status species.

Table 5.5.8-2. Direct Impacts to Vegetation Communities with Implementation of LFTRC Alternative 5

Project Component	*Vegetation Community (acres [ha])*					
	PLF	***SLF***	***HS***	***CP***	***Dev***	***Total***
Range Areas and Associated Features	89.0 (36.0)	110.9 (44.9)	50.3 (20.4)	1.3 (0.5)	63.1 (25.5)	**314.6 (127.3)**
HG Range (at Andersen South)	0	19.4 (7.9)	1.8 (0.7)	0	1.8 (0.7)	**23.0 (9.3)**
Total	**89.0 (36.0)**	**130.3 (44.8)**	**52.1 (18.8)**	**1.3 (0.5)**	**64.9 (26.2)**	**337.6 (136.6)**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; CP = coconut plantation; Dev = developed.

Native limestone forest, both primary and secondary, has been significantly reduced on Guam due to past and ongoing actions including extensive disturbance during and after WWII, widespread planting of non-native species; and impacts from non-native ungulates; development; fire; and deforestation. As stated in Section 3.8.1.1, limestone forests on Guam are important since they retain the functional ecological components of native forest that provide important habitat for the majority of Guam's native species, including ESA-listed, ESA-proposed, and Guam-listed species and Guam SOGCN, as well as maintaining water quality and reducing fire risk. Non-native forest communities (e.g., tangantangan, *Vitex*) significantly alter the forest structure, composition, and resilience to other disturbance processes and do not provide the conditions suitable for native flora and fauna species to persist (Morton *et al.* 2000; GDAWR 2006; Guam Department of Agriculture 2010; JRM 2013).

Of the 18,538 acres (7,502 ha) of primary and secondary limestone forest found on Guam, approximately 13,110 acres (5,305 ha) are found primarily within AAFB, Finegayan, and the NAVMAG (USFS 2006). Under Alternative 5, 89 acres (37 ha) of primary limestone forest and 111 (45 ha) of secondary limestone forest would be removed at NWF (see Table 5.5.8-2). Therefore, given the importance of primary and secondary limestone forest habitat for native species and the continuing loss of native limestone forest across Guam, the conversion of 200 acres (82 ha) of limestone forest to developed area would be a significant but mitigable impact to the regional vegetation community and its function.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on vegetation communities with implementation of LFTRC Alternative 5. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of the contractor education program.
- *Onsite Vegetation Waste Management Procedures. See Section 4.1.8.2 under Construction, Vegetation for a detailed description of the vegetation waste management procedures.*
- *DON Guam Landscaping Guidelines*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of landscaping guidelines.
- *LFTRC Range Berm Controls.* To manage stormwater runoff and control erosion, LFTRC range berms would contain native or non-invasive herbaceous vegetation and other engineering controls.
- *Contractor Plans and Specifications*. All construction would occur within the limits of construction shown in the project figures.

Potential Mitigation Measures

To mitigate for significant impacts to limestone forest, the DON proposes to implement forest enhancement on a minimum of 200 acres (82 ha) of limestone forest. Forest enhancement would include but is not limited to the following actions:

- Ungulate management consisting of exclusion fencing and active control (i.e. trapping, snaring, shooting) with the goal of eradication within the fenced areas.
- Non-native, invasive vegetation removal.
- Propagation, planting, and establishment of native species that are characteristic of native limestone forest habitats (e.g., *A. mariannensis, G. mariannae, F. prolixa, M. citrifolia, W. elliptica*).

The degradation and loss of primary limestone and other forest habitats resulting from ungulate damage and invasion by alien plant species has substantially diminished the extent of habitat for native species in the Mariana archipelago. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including special-status species. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Terrestrial Conservation Areas. Impacts from the construction of the HG Range at Andersen South were discussed in Section 5.1.8.2. As Andersen South does not contain any terrestrial conservation areas, there would be no impacts.

All of the area associated with construction of the ranges under Alternative 5 is within Overlay Refuge (see Figure 4.1.8-3). Overlay Refuge lands were established for the purpose of conserving and protecting ESA-listed species and other native flora and fauna, maintaining native ecosystems, and the conserving native biological diversity, recognizing that the primary purpose of lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force.

Approximately 298 acres (121 ha) of Overlay Refuge lands (Table 5.5.8-3), or 1.4% of the total Overlay Refuge lands on Guam, would be directly impacted under Alternative 5. This area overlaps with the vegetation communities discussed previously. The majority (188 acres [76 ha]) is comprised of limestone forest (Table 5.5.8-3). Therefore, because proposed construction activities would convert 298 acres (121 ha) of Overlay Refuge lands to developed areas, this would be a significant loss to the conservation function of these lands and implementation of Alternative 5 would result in significant but mitigable impacts to terrestrial conservation areas.

Table 5.5.8-3. Impacts to Overlay Refuge with Implementation of LFTRC Alternative 5

Project Component	***Overlay Refuge (acres [ha])***					
	PLF	***SLF***	***HS***	***CP***	***Dev***	***Total***
Range Areas and Associated Features	77.5 (31.4)	110.6 (44.8)	50.0 (20.2)	0.1 (<0.1)	30.6 (12.4)	**254.5 (103.0)**
HG Range (at Andersen South)	0	0	0	0	0	**0**

Legend: PLF = primary limestone forest; SLF = secondary limestone forest; HS = herbaceous scrub; CP = coconut plantation; Dev = developed.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct, long-term impacts of proposed construction activities on terrestrial conservation areas with implementation of Alternative 5. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

The same BMPs discussed above under *Vegetation* would be implemented for terrestrial conservation areas.

Potential Mitigation Measures

To mitigate for significant impacts to terrestrial conservation areas, the DON would submit a proposal to CNO Energy and Environmental Readiness Division to designate an ERA on the NAVMAG to conserve native limestone forest in southern Guam which provides habitat for special-status species. The DON has defined an ERA as a physical area or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural, physical, and biological processes to prevail without human intervention. However, under unusual circumstances, deliberate manipulation (e.g., removal or control of invasive species) may be utilized to maintain the unique feature that the ERA was established to protect (NAVFAC 1996). The proposed NAVMAG ERA would encompass approximately 553 acres (234 ha). Although the proposed NAVMAG ERA is currently part of the Overlay Refuge, implementation of these potential mitigation measures would provide an increased level of protection by further ensuring this area is maintained in

natural and near natural conditions and to have available such areas for research and scientific manipulation (NAVFAC 1996; NAVFAC Marianas 2010).

In addition, the DON proposes to submit a proposal to CNO Energy and Environmental Readiness Division to expand the existing Orote ERA by approximately 32 acres (13 ha) of terrestrial habitat. The Final Orote ERA Expansion proposal was completed FY 2013 and will be submitted for approval in 2014.

Wildlife - Native Species. Short-term construction noise may temporarily impact suitable habitat for native birds in the vicinity of the construction areas, but they would relocate to other areas of suitable habitat in the vicinity, and could return to the area following construction. Non-listed native reptiles are abundant throughout Guam and impacts to vegetation communities under Alternative 5 would result in less than significant impacts to non-listed native reptile populations. Implementation of Alternative 5 would not have a significant adverse effect on a population of any migratory bird species or other native wildlife species. Impacts to wildlife from the construction of the HG Range at Andersen South were discussed in Section 5.1.8.2 and impacts would be less than significant.

Therefore, as presented above, long-term, direct impacts to populations of native wildlife species would not result because these species are abundant in surrounding areas and could repopulate portions of suitable habitat within the affected area after construction. Therefore, direct impacts to native wildlife species would be less than significant with implementation of proposed construction activities associated with Alternative 5.

Proposed construction activities and associated movement of materials onto and off of Guam could increase the potential for the spread of existing or introduction of new non-native invasive species. To prevent the inadvertent spread of non-native species on Guam or to other locations off of Guam, the DON would implement standard biosecurity measures (e.g., HACCP, brown treesnake interdiction measures, coconut rhinoceros beetle vegetation management procedures, and outreach/education) into construction protocols, procedures, and activities.

The following BMPs would be implemented to avoid and minimize potential direct, long-term impacts of proposed construction activities on native wildlife with implementation of Alternative 5.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

With implementation of these BMPs, including development of HACCP plans and ongoing implementation of standard DON biosecurity protocols regarding detection and management of non-native species (e.g., coconut rhinoceros beetle), the potential for the introduction of new or spread of existing non-native species on Guam is substantially reduced. Therefore, there would be less than significant impacts to native wildlife species related to the potential introduction and establishment of non-native species with implementation of proposed construction activities associated with Alternative 5.

Damage of forested areas, particularly primary and secondary limestone forests, by non-native ungulates (i.e., deer and pigs) is a serious concern on Guam. Under Alternative 5, removal of large amounts of limestone forest currently used by ungulates would displace and concentrate ungulates into adjacent areas, resulting in even higher densities and potentially greater habitat damage. Potential impacts from changes in ungulate densities from construction projects within the same or similar habitat areas as proposed in this SEIS were addressed in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.1: North, page 10-115). In addition, the construction of the proposed NWF LFTRC would require the relocation of the ungulate exclosure fence that has been constructed in accordance with conservation measures identified during ESA section 7 consultation for a previous Air Force action (USFWS 2006b). The relocated ungulate exclosure fence would encompass a larger area and disturb a smaller acreage of limestone forest.

The implementation of the potential mitigation measures under the *Vegetation* section above would also benefit native wildlife species. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

Special-Status Species: Federal ESA-Listed and Proposed Species and Critical Habitat

Impacts to special-status species from the construction of the HG Range at Andersen South were discussed in Section 5.1.8.2 and were determined to be less than significant. The following discussion addresses those species that occur within the proposed ranges at NWF under Alternative 5.

MARIANA FRUIT BAT. Approximately 215 acres (87 ha) of Mariana fruit bat recovery habitat would be removed due to proposed construction activities at NWF under Alternative 5. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Additional potential direct temporary impacts to the Mariana fruit bat from construction activities are based on the distances from those activities that are likely to cause disturbance to this species (e.g., noise, human activity, lighting). The evaluation of fruit bat disturbance is based on the approach used by USFWS in previous ESA section 7 formal consultations and associated BOs (e.g., USFWS 2006b, 2010). These distances are: roosting habitat within 492 feet (150 m) and foraging habitat within 328 feet (100 m) from the activity (Wiles, personal communication 2006 and Janeke, personal communication 2006, respectively, as cited in USFWS 2006b).

The species is currently limited to the few areas on Guam away from human activities and with suitable habitat, primarily on federal lands on the NAVMAG and AAFB (JRM *et al.* 2012a, 2012b; JRM 2013; A. Brooke, NAVFAC Marianas, personal communication). However, illegal hunting, loss and degradation of native forest, predation by the brown treesnake, and the increased extirpation risk owing to the high vulnerability of very small populations continue to limit the potential recovery of the species on Guam (USFWS 2010a; JRM 2013). Based on the equilibrium/carrying capacity of snakes on Guam (Rodda and Savidge 2007), implementation of the proposed action is not expected to increase the likelihood of predation by the brown treesnake on Mariana fruit bats.

Although the loss of 215 acres (87 ha) of fruit bat recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, it would reduce the total number of bats that the island can support. Given this loss of recovery habitat and the critically low numbers of bats on Guam, there would be significant but mitigable impacts to the Mariana fruit bat.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on Mariana fruit bats with implementation of Alternative 5. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Pre-Construction Surveys*. Surveys would be completed within suitable fruit bat habitat 1 week prior to onset of construction activities following the USFWS-approved JRM protocol. If a fruit bat is present within 492 feet (150 m) of the project site, the work must be postponed until the bat has left the area.
- *Lighting Installation*. Lighting would be designed to meet minimum safety, sustainability, and AT/FP requirements. Either hooded or "night-adapted" lights would be installed at LFTRC Alternative 5 at NWF. Hooded lights would be used to the maximum extent practicable at all new roads and facilities within known fruit bat roost areas. Illumination of forest would be kept to an absolute minimum.

Potential Mitigation Measures

The same potential mitigation measures discussed previously under *Vegetation* (i.e., forest enhancement of 200 acres [82 ha] of limestone forest) would be applicable for the Mariana fruit bat and its recovery habitat. The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana fruit bat. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

Mariana Fruit Bat Critical Habitat. Section 7 of the federal ESA requires federal agencies to insure that their actions are not likely to result in the destruction or adverse modification of designated critical habitat. In 1986, the USFWS and NMFS promulgated regulations governing interagency cooperation under ESA section 7. These regulations (50 CFR 402.02) defined "destruction or adverse modification" of critical habitat to mean "a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical." This definition was found to be invalid by the U.S. Court of Appeals for the 5th (2001) and 9th (2004) Circuits.

In response to these rulings and pending the adoption of any new regulatory definition of "destruction or adverse modification," the USFWS provided guidance in 2004 regarding consultations concerning critical habitat (USFWS 2004b). The evaluation of effects to designated critical habitat should consider the statutory provisions of the ESA and not the regulatory definition at 50 CFR 402.02. USFWS (2004b) provided the following guidance to assist in applying these considerations in section 7(a)(2) consultations on federal actions that may affect designated critical habitat:

- Discuss the entire designated critical habitat area in terms of the biological and physical features that are essential to the conservation (discussion of "survival" in this and other sections of the adverse modification analysis is not appropriate) of the species. The analysis should identify and discuss the PCEs of the critical habitat.
- Describe how the PCEs essential to the conservation of the species are likely to be affected and, in turn, how that will influence the function and conservation role of the affected critical habitat unit.
- Discuss whether, with implementation of the proposed federal action, critical habitat would remain functional (or retain the current ability for the PCEs to be functionally established) to serve the intended conservation role for the species (USFWS 2004b).

The above guidance was used for the ESA section 7 analysis of impacts to designated Mariana fruit bat, Mariana crow, and Guam Micronesian kingfisher critical habitat in this SEIS.

The area within the southwestern portion of the critical habitat area, adjacent to the Guam NWR boundary, would be used for the relocation of the existing USFWS facilities that are currently located to the northeast, near Ritidian Point (see Figure 5.5.8-3). Two additional areas near Ritidian Point in the center of the critical habitat area are developed areas containing the existing NWR administrative buildings, roads, and parking lots. In accordance with the final rule designating critical habitat (USFWS 2004a), developed areas were not designated critical habitat; therefore, proposed construction activities within these two areas would not affect critical habitat.

The proposed area for the relocated USFWS facilities and associated road and parking lot contains 11 acres (5 ha) of primary limestone forest supporting both PCEs for fruit bat critical habitat (see Figure 5.5.8-3). Noise and disturbance-related construction impacts would be temporary in nature. The proposed 11-acre (5-ha) construction area is already subject to daily human disturbance due to aircraft operations and other DoD activities at AAFB, and its proximity to the access road to the Guam NWR, adjacent beaches, and private property to the southwest. In addition, appropriate BMPs would be implemented during construction to avoid and minimize impacts to fruit bats (e.g., pre-construction fruit bat surveys and installation of appropriate lighting in the vicinity of fruit back habitat [e.g., hooded lights will be used to the maximum extent possible to avoid and minimize the illumination of forest]. Although construction would directly impact 11 acres (5 ha) of designated critical habitat, the remaining critical habitat would remain functional (or retain the current ability for the PCEs to be functionally established) to serve the intended conservation role for the fruit bat. Accordingly, given the above, construction impacts would not appreciably diminish the value of the critical habitat for both the survival and recovery of the Mariana fruit bat.

Additional potential impacts to Mariana fruit bat critical habitat could occur during temporary construction activities (e.g., noise, lighting, and general human disturbance) associated with the proposed ranges at NWF that would be adjacent to critical habitat. However, the 2004 designation of critical habitat by the USFWS (USFWS 2004a) stated that "the presence of auditory or visual human disturbances does not affect the presence of the primary constituent elements used to define critical habitat." This area is already subject to daily human disturbance due to aircraft operations and other DoD activities at AAFB, and its proximity to the access road to the Ritidian Unit of the Guam NWR, adjacent beaches, and private property to the southwest. Implementation of BMPs (e.g., installation of hooded lights in the vicinity of fruit bat critical habitat) will be used to the maximum extent possible to avoid and minimize the illumination of forest and critical habitat.

In summary, impacts to 11 acres (5 ha) of fruit bat critical habitat as a result of construction activities associated with the relocation of USFWS facilities and construction of LFTRC would be less than significant and the remaining area of critical habitat would remain functional to serve the intended conservation role for the Mariana fruit bat.

MARIANA CROW. The Mariana crow is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the crow is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the crow, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 5, impacts to the crow would be limited to recovery prospects. If crows are reintroduced and exposed to construction activities under Alternative 5, they may be disturbed (DON 2014).

Although the crow no longer occurs on Guam, approximately 215 acres (87 ha) of crow recovery habitat would be removed due to proposed construction activities at NWF under Alternative 5. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Although the loss of 215 acres (87 ha) of crow recovery habitat on Guam would not preclude the recovery of the crow should it be reintroduced to Guam in the future, it would reduce the total number of crows that the island can support. If and when the crow is reintroduced to Guam, the best available information indicates project-related noise would not further reduce the amount of recovery habitat suitable for this species' breeding, feeding and sheltering (USFWS 2010a). Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Mariana crow.

The following BMPs and potential mitigation measures may be implemented to avoid, reduce, and mitigate potential direct long-term impacts of proposed construction activities on the recovery of the Mariana crow with implementation of Alternative 5. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.

- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 200 acres [82 ha] of limestone forest) would be applicable for the Mariana crow and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Mariana crow, should it be reintroduced to Guam in the future.

Mariana Crow Critical Habitat. As the Mariana crow is currently extirpated from Guam, designated crow critical habitat is considered unoccupied. Per the previous discussion for the Mariana fruit bat, only one area of designated critical habitat would be impacted by construction activities under Alternative 5 (Figure 5.5.8-3). The existing USFWS facilities of the Ritidian Unit of the Guam NWR would be relocated to an area within the southwestern portion of the critical habitat area, adjacent to the Guam NWR boundary. This area consists of primary limestone forest supporting PCEs 1 and 3 for crow critical habitat. Given the presence of the existing access road within this area, the area does not support PCE 2: areas of limestone forest to allow nesting at least 950 feet (290 m) from the nearest road.

The proposed area for the relocated USFWS facilities and associated road and parking lot contains 11 acres (5 ha) of primary limestone forest supporting PCEs for crow critical habitat (see Figure 5.5.8-3). Noise and disturbance-related construction impacts would be temporary in nature. The proposed 11-acre (5-ha) construction area is already subject to daily human disturbance due to aircraft operations and other DoD activities at AAFB, and its proximity to the access road to the Guam NWR, adjacent beaches, and private property to the southwest. Although construction would directly impact 11 acres (5 ha) of designated critical habitat, the remaining critical habitat would remain functional (or retain the current ability for the PCEs to be functionally established) to serve the intended conservation role for the crow. Accordingly, given above, construction impacts would not appreciably diminish the value of the critical habitat for the recovery of the Mariana crow.

Additional potential impacts to Mariana crow critical habitat could occur during temporary construction activities (e.g., noise, lighting, and general human disturbance) associated with the proposed ranges at NWF that would be adjacent to critical habitat. However, the 2004 designation of critical habitat by the USFWS (USFWS 2004a) stated that "the presence of auditory or visual human disturbances does not affect the presence of the primary constituent elements used to define critical habitat."

In summary, impacts to 11 acres (5 ha) of crow critical habitat as a result of construction activities associated with the relocation of USFWS facilities within the Ritidian Unit of the Guam NWR and construction of LFTRC would be less than significant and the remaining area of critical habitat would remain functional to serve the intended conservation role for the Mariana crow.

GUAM MICRONESIAN KINGFISHER. The kingfisher is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the kingfisher is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the kingfisher, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the kingfisher is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 5, impacts to the kingfisher would be limited to

recovery prospects. If kingfishers are reintroduced and exposed to construction activities under Alternative 5, they may be disturbed (DON 2014).

Although the kingfisher no longer occurs on Guam, approximately 215 acres (87 ha) of kingfisher recovery habitat would be removed due to proposed construction activities under Alternative 5. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

Although this loss of recovery habitat on Guam would not preclude the recovery of the kingfisher should it be reintroduced to Guam in the future, it would reduce the total number of kingfishers that the island can support. Given this loss of recovery habitat, there would be significant but mitigable impacts to the recovery of the Guam Micronesian kingfisher.

The following BMPs and potential mitigation measures may be implemented to avoid, minimize, and mitigate potential direct and indirect long-term impacts of proposed construction activities on the recovery of the Guam Micronesian kingfisher with implementation of Alternative 5. Final mitigation measures will be identified in the ROD after resource agency consultations are completed.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

Potential Mitigation Measures

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 200 acres [82 ha] of limestone forest) would be applicable for the kingfisher and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam Micronesian kingfisher, should it be reintroduced to Guam in the future.

As part of the ESA section 7 consultation process, the DON and the USFWS entered into an MOA which would, if the preferred alternative is chosen, facilitate kingfisher conservation goals. In the MOA, the DON agreed to designate approximately 5,234 acres (2,118 ha) under the custody and control of the DoD in northern Guam to a status that will provide durable habitat protection needed to support native habitat restoration and land management for the survival and recovery of the kingfisher. Consistent with the JRM INRMP developed in accordance with Section 101 of the Sikes Act, the DON agreed to actively restore

native habitat and manage, in collaboration with the USFWS, the 5,234 acres (2,118 ha) consistent with DoD's obligations under ESA section 7(a) and the Sikes Act to benefit the survival and recovery of the kingfisher. The DON would work cooperatively with the USFWS to identify, develop and implement specific management activities and projects on these 5,234 acres (2,118 ha) to support the reintroduction and recovery of the kingfisher.

These 5,234 acres (2,118 ha) have been identified by the USFWS as habitat for the kingfisher and needed to offset impacts of the proposed action. The DON and USFWS recognize that the designation of the 5,234 acres (2,118 ha) may also provide a conservation benefit to other ESA-listed species with similar habitat requirements (e.g., Mariana crow, Mariana fruit bat).

Guam Micronesian Kingfisher Critical Habitat. As the Guam Micronesian kingfisher is currently extirpated from Guam, designated kingfisher critical habitat is considered unoccupied. Per the previous discussion for the Mariana fruit bat, only one area of designated critical habitat would be impacted by construction activities under Alternative 5 (see Figure 5.5.8-3). The existing USFWS facilities within the Ritidian Unit of the Guam NWR would be relocated to an area within the southwestern portion of the critical habitat area, adjacent to the Guam NWR boundary. This area consists of primary limestone forest supporting all PCEs for kingfisher critical habitat.

The proposed area for the relocated USFWS facilities and associated road and parking lot contains 11 acres (5 ha) of primary limestone forest supporting PCEs for kingfisher critical habitat (see Figure 5.5.8-3). Noise and disturbance-related construction impacts would be temporary in nature. The proposed 11-acre (5-ha) construction area is already subject to daily human disturbance due to aircraft operations and other DoD activities at AAFB, and its proximity to the access road to the Guam NWR, adjacent beaches, and private property to the southwest. Although construction would directly impact 11 acres (5 ha) of designated critical habitat, the remaining critical habitat would remain functional (or retain the current ability for the PCEs to be functionally established) to serve the intended conservation role for the kingfisher. Accordingly, given the above, construction impacts would not appreciably diminish the value of the critical habitat for the recovery of the Guam Micronesian kingfisher.

Additional potential impacts to kingfisher critical habitat could occur during temporary construction activities (e.g., noise, lighting, general human disturbance) associated with the proposed ranges at NWF that would be adjacent to critical habitat. However, the 2004 designation of critical habitat by the USFWS (USFWS 2004a) stated that "the presence of auditory or visual human disturbances does not affect the presence of the primary constituent elements used to define critical habitat."

In summary, impacts to 11 acres (5 ha) of kingfisher critical habitat as a result of construction activities associated with the relocation of USFWS facilities and construction of LFTRC would be less than significant and the remaining area of critical habitat would remain functional to serve the intended conservation role for the Guam Micronesian kingfisher.

GUAM RAIL. The Guam rail is extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of the rail is reasonably certain to occur and it is likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of the rail, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the rail is successfully re-introduced and then has the potential to be exposed to construction activities under Alternative 5, impacts to the rail would be limited to recovery prospects. If rails are reintroduced and exposed to construction activities under Alternative 5, they may be disturbed (DON 2014).

Although the rail no longer occurs on Guam, approximately 82 acres (33 ha) of rail recovery habitat would be removed due to proposed construction activities under Alternative 5. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species.

This loss of recovery habitat on Guam would not preclude the recovery or survival of the rail should it be reintroduced to Guam in the future, and it would not substantially reduce the total number of rails that the island can support. Given this small loss of recovery habitat on Guam, there would be less than significant impacts to the Guam rail with implementation of proposed construction activities associated with Alternative 5.

The following BMPs may be implemented to avoid and reduce potential long-term impacts of proposed construction activities on the recovery of the Guam rail with implementation of Alternative 5.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2 under Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.
- *Brown Treesnake Interdiction*. See Section 4.1.8.2, Construction, *Wildlife - Native Species* for a detailed description of the brown treesnake interdiction program.

In addition, potential mitigation measures proposed above for vegetation and the Mariana crow would benefit the Guam rail.

- *Brown Treesnake Suppression or Eradication*. See Section 4.1.8.2, Construction, *Special-Status Species*, MARIANA CROW for a detailed description of the brown treesnake suppression or eradication program.
- The same potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 200 acres [82 ha] of limestone forest) would be applicable for the rail and its recovery habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk). The anticipated benefit of implementing these mitigation measures is improved habitat quality for native flora and fauna, including the Guam rail, should it be reintroduced to Guam in the future.

MARIANA EIGHT-SPOT BUTTERFLY. Host plants and adult, immature, and egg stages of the eight-spot butterfly have been observed within the proposed MPMG and Non-standard Small Arms ranges associated with Alternative 5 (see Figure 5.5.8-3) (NAVFAC Marianas 2013; NAVFAC Pacific 2013b). With implementation of appropriate BMPs to avoid and minimize potential impacts to eight-spot butterflies (e.g., pre-construction butterfly and host plant surveys within the proposed range areas and salvage/relocation of host plants, larvae or eggs; see Table 2.8-1), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed construction activities under Alternative 5. In addition, implementation of the potential mitigation measures described above under *Vegetation* (i.e., forest enhancement of 200 acres [82 ha] of limestone forest) would also benefit the

survival the eight-spot butterfly. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species, including eight-spot butterfly host plants.

GUAM TREE SNAIL. As discussed previously in the Affected Environment section (see 5.5.8.1, *Special-Status Species: Federal ESA-Listed and Proposed Species and Designated Critical Habitat*), the Guam tree snail has not been observed within the proposed impacted areas of the NWF LFTRC alternative and therefore would not be impacted by proposed construction activities. However, the USFWS regularly conducts tree snail surveys at 88 stations along 9 transects within the Ritidian Unit of the Guam NWR. Two survey stations along one transect lie within the footprint of the proposed beach access near the proposed location for relocated USFWS facilities and would be removed from future survey efforts (see Figure 2.5-6). Based on existing USFWS survey data, tree snails have not been observed at these two survey stations (J. Cruce, Wildlife Refuge Specialist, Guam NWR, USFWS, personal communication, 2014). The loss of these two survey stations would not be a significant impact to the long-term survey effort by the USFWS.

SERIANTHES TREE. The only known mature *Serianthes* tree on Guam is located on the northwest corner of the potential impacted area associated with the proposed MPMG Range (see Figure 5.5.8-2). Current literature regarding the protection of trees from construction activities recommend a protective buffer based on the diameter at breast height (dbh) of the subject tree (Oregon State University 2009; University of Hawaii 2010; Johnson 2013). This buffer is related to the "critical root radius" approach which is calculated by measuring the dbh in inches. For each inch of dbh, allow for 1.5 feet (0.5 m) of critical root radius for sensitive, older, or unhealthy trees, or 1 foot (0.3 m) for tolerant, younger, healthy trees to ensure protection of the root zone. Therefore, based on the current dbh of 22.4 inches (57 cm) for the subject *Serianthes* at NWF, the buffer would be approximately 34 feet (10 m). To avoid any impacts to this tree, a minimum buffer of 100 feet (30 m) would be established around the tree and no activities would be permitted within this buffer. Therefore, there would be no impacts to the *Serianthes* tree with implementation of the proposed construction activities associated with Alternative 5.

Approximately 177 acres (71 ha) of *Serianthes* recovery habitat would be removed due to proposed construction activities under Alternative 5. This area is included in the impacts to vegetation and Overlay Refuge lands discussed above. See Section 3.8.3.2 for a discussion of recovery habitat and its use as a criterion for assessing impacts to ESA-listed species. Although this loss of recovery habitat on Guam would not preclude the recovery of *Serianthes*, it would reduce the total number of *Serianthes* that the island can support. Given this loss of recovery habitat on Guam, there would be significant but mitigable impacts to the recovery of *Serianthes* on Guam with implementation of proposed construction activities associated with Alternative 5.

The following BMPs may be implemented to avoid and minimize, potential direct long-term impacts of proposed construction activities on the recovery of *Serianthes* with implementation of Alternative 5.

Best Management Practices

- *HACCP Plan*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of HACCP planning.
- *Biosecurity Outreach and Education*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of biosecurity outreach and education.
- *Contractor Education Program*. See Section 4.1.8.2, Construction, *Vegetation* for a detailed description of the contractor education program.

- The one remaining adult *Serianthes* tree at NWF is in poor condition due to termites and rotting at the base. The tree is leaning which renders it more susceptible to snapping or toppling in the event of a catastrophic typhoon. Guide wires would be installed to support the tree at NWF thereby reducing the potential for its collapse.

The implementation of the potential mitigation measures discussed above under *Vegetation* (i.e., forest enhancement of 200 acres [82 ha] of limestone forest) would benefit *Serianthes* habitat. In particular, the objectives of ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures. Forest enhancement would also support natural regeneration and seed propagation, reduce erosion, and increase water retention (i.e., reduces fire risk).

BULBOPHYLLUM GUAMENSE and *PSYCHOTRIA MALASPINAE*. There is a reported single occurrence of each species within the northern portion of the MPMG range at NWF (see Figure 5.5.8-3). Proposed construction activities would potentially impact 1 individual *B. guamense* out of approximately 250 individuals on Guam. Although *P. malaspinae* has been reported from the NWF area, no individuals have been seen in the past 5 years (USFWS 2014a). If detected during pre-construction surveys, both species would be salvaged to the maximum extent practicable and translocated to suitable habitat (see Section 2.8). With the implementation of BMPs, such as potential translocation of *B. guamense* and *P. malaspinae* to suitable habitat, there would be less than significant impacts to both species with implementation of the construction activities associated with Alternative 5. In addition, the implementation of the potential mitigation measures under the *Vegetation* section above would also benefit the survival of these species. In particular ungulate management, control/suppression of invasive plants, and outplanting of native species proposed under the forest enhancement mitigation measures.

Special-Status Species: Guam-Listed and SOGCN

Guam-listed species and SOGCN are also ESA-listed species and potential impacts to these species are discussed above.

Operation

Vegetation. With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of Alternative 5 is considered unlikely. Therefore, there would be less than significant impacts to vegetation with operation of the proposed LFTRC under Alternative 5.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by increasing erosion, allowing for the establishment of non-native species, and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. Native plants and their habitats on Guam are adapted to a humid, tropical climate and are not adapted to a fire driven ecosystem (USFWS 2008a).

As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's Wildland Fire Management Plan (Nelson 2008) (see Section 2.8). It would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions), and location and management of firebreaks,

fire-fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). With implementation of the Range Fire Management Plan, which establishes management and fire suppression and emergency response procedures, potential impacts from range-related wildfires would be less than significant. The USFWS concluded in their BO for the 2010 Final EIS that they anticipated that no additional vegetation would be lost due to wildfires igniting as a result of proposed live-fire training operations (USFWS 2010a). Therefore, there would be less than significant impacts to vegetation from operation of LFTRC Alternative 5.

Terrestrial Conservation Areas. Impacts to terrestrial conservation areas from the operation of the HG Range at Andersen South were discussed in Section 5.1.8.2. As Andersen South does not contain any terrestrial conservation areas, there would be no impacts.

Modeled noise levels greater than 55 dB ADNL from proposed live-fire range operations would overlie approximately 1,691 acres (684 ha) of Overlay Refuge lands on AAFB NWF (Table 5.5.8-4 and Figure 5.5.8-4). Overlay Refuge lands were established for the purpose of conserving and protecting ESA-listed species and other native flora and fauna, maintaining native ecosystems, and the conserving native biological diversity, recognizing that the primary purpose of lands within the Overlay Refuge is to support the national defense missions of the Navy and Air Force.

Table 5.5.8-4. Noise Levels within Overlay Refuge Lands with Implementation of LFTRC Alternative 5 (acres [ha])

55-64 dB ADNL	*65-74 dB ADNL*	*75-85+ dB ADNL*	*Total*
531.2 (215.0)	628.9 (254.5)	531.4 (215.1)	**1,691.5** **(684.5)**

Existing noise levels at NWF are composed of airfield operations in flight tracks going to and from AAFB; aviation training by H-60, H-46, H-53, V-22, H-1 and C-130 aircraft at NWF; and ground-based training using pyrotechnics, ground burst simulators, smoke grenades, and 40-pound cratering charges. Although there would be noise due to proposed LFTRC activities combined with the existing aviation and ground-based training, the current and proposed noise-generating activities would not result in a significant change in the noise environment at NWF and there would not be a loss of the conservation function of Overlay Refuge lands at NWF.

Access to the Ritidian Unit of the Guam NWR and the USGS Brown Treesnake Research Exclosure at NWF will be granted at approved times such as when lands are not being used for military training. Upon entering an operational phase, coordination of specific dates for range usage would be scheduled by Range Operations. With appropriate coordination and in accordance with DoD security protocols, the DON would allow research and monitoring of biological resources by local, university, and federal researchers on Guam NWR and DON lands. Therefore, the areas would remain functional to serve their intended conservation role for listed and at-risk species. Additionally, pursuant to pending legislation in the FY 2015 National Defense Authorization Act, the DON and the USFWS will enter into an agreement that provides for the management of the Ritidian Unit to ensure sensitive resources are appropriately protected and managed.

Therefore, there would be less than significant impacts to terrestrial conservation areas with implementation of Alternative 5.

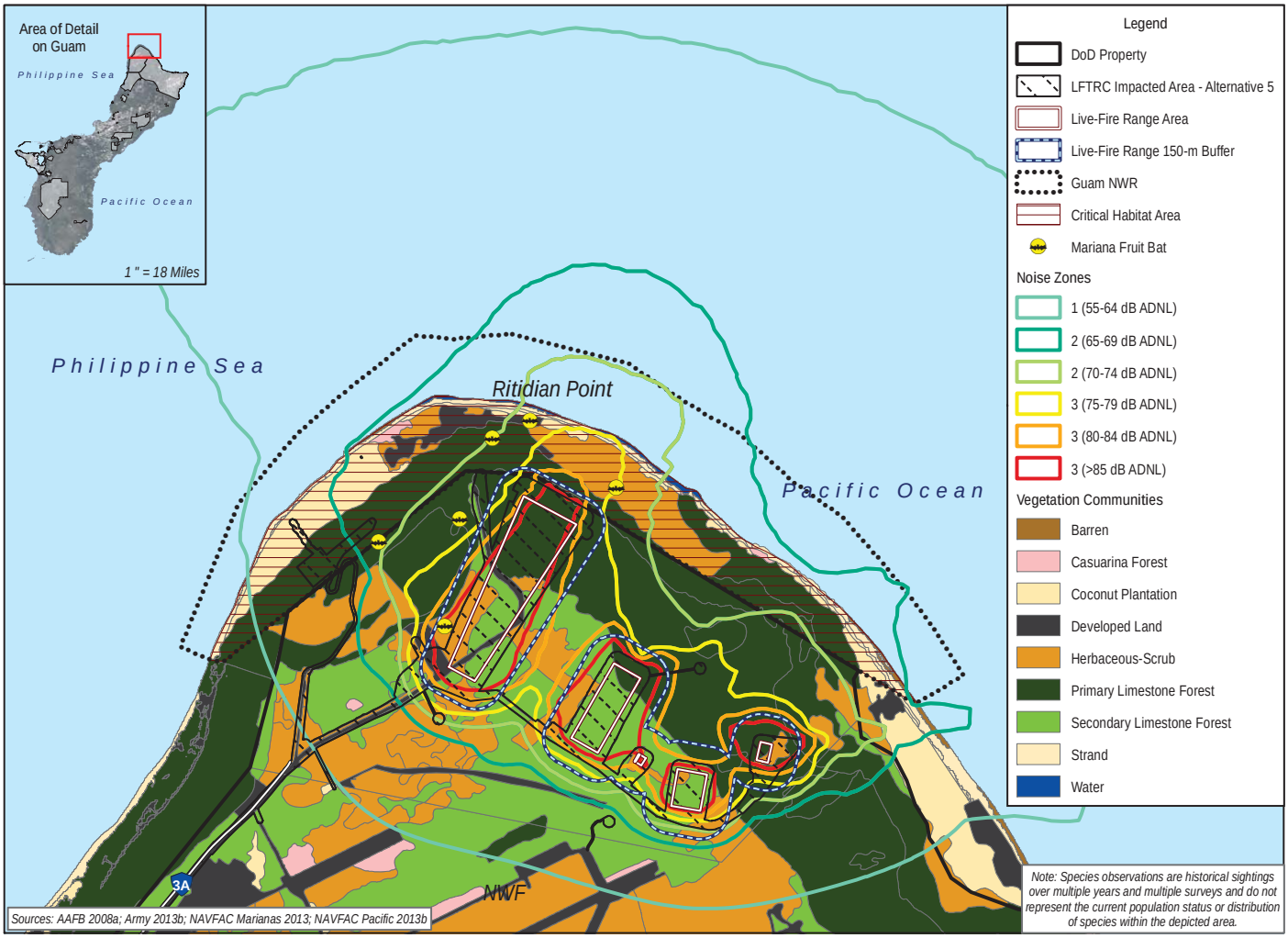


Figure 5.5.8-4
Vegetation Communities and Mariana Fruit Bat Observations within
Small Arms ADNL Noise Zones - NWF LFTRC Alternative

Wildlife - Native Species. Operational impacts to native wildlife would include an increase in noise and lighting. These potential impacts were evaluated in the 2010 Final EIS (Volume 2, Chapter 10: Terrestrial Biological Resources, Section 10.2.2.2: Central, page 10-129) for a similar proposed action, and were found to be not significant. With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of the proposed LFTRC under Alternative 5 is considered unlikely. The DON recognizes the USFWS' ongoing concern regarding potential spread of the brown treesnake. The DON will consult with USFWS under ESA section 7 to determine if additional brown treesnake interdiction measures are warranted and applicable. In addition, lighting associated with the range and support areas would be hooded or shielded to the maximum extent practicable to prevent unnecessary light beyond operational areas. Therefore, there would be less than significant impacts to native wildlife with operation of the proposed LFTRC under Alternative 5.

Special-Status Species: Federal ESA-Listed and Proposed Species and Critical Habitat

MARIANA FRUIT BAT. The assessment of noise levels associated with the proposed HG Range at Andersen South was previously discussed in Section 5.1.8.2. There would be no impacts to Mariana fruit bats from noise associated with operation of the HG Range.

For those species of fruit bats that have been tested for hearing sensitivity, their audiograms are very similar to those of humans, with similar upper and lower frequency limits and hearing threshold levels (Calford *et al.* 1995; Koay *et al.* 1998; Heffner *et al.* 2006). Therefore, it is likely that noise from live-fire operations at the proposed ranges would be heard by fruit bats as it would be heard by humans.

The USFWS established 60 dB and 93 dB as two thresholds of biological significance based on their review of impacts of noise to wildlife. Noise levels above 60 dB have been found to affect acoustic communication, breeding biology, survival of young, and non-auditory bird and mammal physiology. Noise levels above 93 dB may temporarily or permanently affect hearing (USFWS 2010a). No species would be exposed to noise levels of 93 dB or greater under the proposed action. While noise levels may approach 93 dB in the immediate vicinity of the firing of an individual weapon, fruit bats or other wildlife species would not be in proximity to the live-fire event given the location and nature of weapons firing within a developed range area.

Responses to noise can vary among individuals as a result of habituation where after a period of exposure to a stimulus, an animal stops responding to the stimulus. In general, a species can often habituate to human-generated noise when the noise is not followed by an adverse impact. Even when a species appears to be habituated to a noise, the noise may produce a metabolic or stress response (increased heart rate results in increased energy expenditure) though the response may or may not lead to changes in overall energy balance. Anthropogenic noise disturbance is known to alter animal behavioral patterns and lead to population declines (Barber *et al.* 2011; Francis and Barber 2013; McGregor *et al.* 2013).

In addition to noise level, the frequency and regularity of the noise also affect species sensitivity. That is, different types of noise sources will produce different effects on different species. Noise from aircraft overflights may not produce the same response from a wildlife species as noise from a land-based noise source such as a vehicle, chainsaw, or gun shot. Wildlife species often do not react only to a noise source but more importantly to the visual component associated with that noise source. Nesting birds will react to a noise source by tilting their head, becoming alert, etc. but often do not leave the nest or perch until

there is a visual connection with the noise source. For example, birds may not react to just the sound of a chainsaw, but when that sound is coupled with a human walking near the bird, the bird will flush. This is also shown in reactions by various species to aircraft overflights (airplanes and helicopters). An overflight with just a sound component does not elicit a strong response, but if an animal hears and then sees the aircraft, the bird will more likely flush and move away (Manci *et al.* 1988; USFWS 1992; Krausman *et al.* 1993; Bowles 1995). In other words, human intrusions near roost sites, nests, foraging areas, etc. (e.g., timber harvesting, hiking, hunting) are readily detectable and substantial (USFS 1992).

Species that are commonly hunted often demonstrate behavioral (e.g., flushing, startle response) or physiological responses (e.g., increased heart rates, increased respiration rates) to gunshot sounds (Larkin *et al.* 1996). Knight *et al.* (1987) found that American crows nesting in urban areas were less wary of people than American crows nesting in rural habitat and attributed the difference to the hunting of rural crows. Barron *et al.* (2012) found that American crows avoided areas with live-fire exercises in a similar fashion and suggested that species hunted by humans will be more adversely affected by human activity, including military training (e.g., live-fire training) than species that are not hunted.

As stated by Morton and Wiles (2002), "Poaching is a particularly insidious activity because not only does it impact fruit bats through mortality, it reinforces behavioral avoidance of humans. Consequently, roosting or foraging fruit bats that might not otherwise be disturbed by some human activities … may become unduly sensitized to them because of illegal hunting." Based on observations on Guam and Rota, fruit bats have abandoned areas where hunting has occurred and did not return even though no further hunting or gunshots occurred within the area for months after (Janeke 2006; AAFB 2008b; USFWS 2009a; Mildenstein and Mills 2013). In addition, anecdotal evidence from numerous individuals who have conducted fruit bat research on Guam and the CNMI for many years indicate that fruit bats do avoid areas that have been previously subjected to hunting and also areas that experience live-fire activities (G. Wiles, Washington Department of Fish and Wildlife, personal communication, 2014; T. Mildenstein, University of Montana, personal communication, 2014; D. Janeke, HDR, Inc., personal communication, 2014; N. Johnson, Marianas Conservation Unlimited, personal communication, 2014). For example, during fruit bat monitoring at AAFB near the CATM range as part of a larger study monitoring the effects of aircraft overflights on fruit bats and crows (JRM *et al.* 2012b), N. Johnson observed flying fruit bats avoid the CATM range by 300-400 m when live-fire operations were being conducted (N. Johnson, Marianas Conservation Unlimited, personal communication, 2014).

However, a species can also habituate to human-generated noise when the noise is not followed by an adverse impact. While fruit bats may avoid an area subjected to hunting and the associated gun shots, fruit bats, like most wildlife species, will also learn that if a disturbance or sound does not produce an adverse effect (e.g., mortality), then they can habituate to that disturbance or sound and will not show an adverse reaction (e.g., flying away, avoiding the area) (Boyle and Samson 1985; Francis and Barber 2013).

Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) may influence reproductive success and confound the ability to identify the ultimate factor in limiting productivity of a certain species, area, or region (Smith *et al.* 1988).

Based on identified recovery habitat for the Mariana fruit bat (USFWS 2010b), noise levels of 60 dB ADNL and greater would overlie 1,101 acres (446 ha) of recovery habitat in the vicinity of Alternative 5 (Table 5.5.8-5 and Figure 5.5.8-4).

Table 5.5.8-5. Noise Levels overlying Mariana Fruit Bat Recovery Habitat (acres [ha]) with Implementation of LFTRC Alternative 5

60-64 dB ADNL	*65-74 dB ADNL*	*75-85+ dB ADNL*	*Total*
143.0 (57.9)	523.5 (211.9)	434.8 (176.0)	**1,101.3** **(445.7)**

Given the ongoing poaching of fruit bats on Guam, it is likely that those fruit bats that currently occur on Guam will avoid areas of live-fire training as they may have experienced a poaching event. While there is the potential for eventual habituation by fruit bats to LFTRC live-fire activities, fruit bats are expected to initially avoid areas of live-fire training activities. Therefore, fruit bats may temporarily avoid approximately 1,101 acres (446 ha) of recovery habitat due to proposed live-fire range operations. However, proposed live-fire operations at the LFTRC are not continuous and would occur between 7:00 a.m. and 7:00 p.m. for 39 weeks per year, and night operations (estimated to occur 2 nights per week over 39 weeks per year) would occur between 7:00 p.m. and 10:00 p.m. or 6:00 a.m. and 7:00 a.m. In addition, live-fire operations would not physically impact recovery habitat. This temporary avoidance of recovery habitat on Guam would not preclude the recovery or survival of the fruit bat, and it would not substantially reduce the total number of fruit bats that the island can support.

With implementation of BMPs (see previous discussion of construction impacts under *Vegetation*), including ongoing implementation of standard DON and commercial biosecurity protocols (e.g., Port of Guam, A.B. Won Pat International Airport) regarding detection and management of non-native species, invasive species outreach and education, and 1-year post-construction monitoring to evaluate effectiveness of HACCP, the potential for the introduction of new or spread of existing non-native species on Guam during the operation of Alternative 5 is considered unlikely. Therefore, there would be less than significant impacts to the Mariana fruit bat with implementation of proposed operational activities associated with Alternative 5.

Mariana Fruit Bat Critical Habitat. Potential impacts to Mariana fruit bat critical habitat could occur during range operations (e.g., noise, lighting, and general human disturbance) associated with the proposed ranges at NWF that would be adjacent to critical habitat. However, the 2004 designation of critical habitat by the USFWS (USFWS 2004a) stated that "the presence of auditory or visual human disturbances does not affect the presence of the primary constituent elements used to define critical habitat." This area is already subject to daily human disturbance due to aircraft operations and other DoD activities at AAFB, and its proximity to the access road to the Guam NWR, adjacent beaches, and private property to the southwest. Implementation of BMPs (e.g., installation of hooded lights in the vicinity of fruit bat critical habitat) will be used to the maximum extent possible to avoid and minimize the illumination of forest and critical habitat. Therefore, the operation of Alternative 5 would result in less than significant impacts to fruit bat critical habitat and critical habitat would remain functional to serve the intended conservation role for the fruit bat.

MARIANA CROW, GUAM RAIL, AND GUAM MICRONESIAN KINGFISHER. These species are extirpated and no longer present on Guam, due primarily to predation by the brown treesnake. The USFWS, however, has advised the DON that it is reasonably certain that the effects of the proposed action are likely to persist during the lifespan of the proposed action and overlap the period when reintroduction of these species is reasonably certain to occur and the species are likely to be exposed to the effects of the action. There are currently neither projected dates for re-introduction of these species, nor successful suppression of the brown treesnake to a level which would support re-introduction. Until the crow, rail, and kingfisher are successfully re-introduced and then have the potential to be exposed to operational activities under

Alternative 5, there would be no impact to these species. If the species are reintroduced and exposed to LFTRC operational activities under Alternative 5, they may be disturbed.

Mariana Crow and Guam Micronesian Kingfisher Critical Habitat. Potential impacts to Mariana crow and Guam Micronesian kingfisher critical habitat would be the same as previously discussed for the fruit bat. Therefore, the operation of Alternative 5 would result in less than significant impacts to crow and kingfisher critical habitat and critical habitat would remain functional to serve the intended conservation role for both species.

GUAM TREE SNAIL. As discussed previously in the Affected Environment section (see 5.5.8.1, *Special-Status Species: Federal ESA-Listed and Proposed Species and Designated Critical Habitat*), the Guam tree snail has not been observed within the proposed impacted areas of the NWF LFTRC alternative. However, the USFWS regularly conducts tree snail surveys at 88 stations along 9 transects within the Ritidian Unit of the Guam NWR (J. Cruce, Wildlife Refuge Specialist, Guam NWR, USFWS, personal communication, 2014). Two survey transects composed of 20 survey stations would be within the proposed SDZs of the LFTRC at NWF. Upon entering an operational phase, coordination of specific dates for range usage would be scheduled by Range Operations. With appropriate coordination and in accordance with DoD security protocols, the DON would allow research and monitoring of biological resources by local, university, and federal researchers within the SDZs and DON lands. Therefore, the areas would remain functional to serve their intended conservation role for listed and at-risk species. Additionally, pursuant to pending legislation in the FY 2015 National Defense Authorization Act, the DON and the USFWS will enter into an agreement that provides for the management of the Ritidian Unit to ensure sensitive resources (e.g., tree snails) are appropriately protected and managed. Therefore, there would be less than significant impacts to tree snail research and management with implementation of Alternative 5.

MARIANA EIGHT-SPOT BUTTERFLY. Some species of tropical butterflies have well-developed ears on their wings and can detect sounds at the same frequencies that humans can hear. It is hypothesized that the butterflies are listening to the flight sounds or foraging calls of predatory birds (Lane *et al.* 2008; Yack 2012). Given the low numbers of forest birds currently on Guam due to the brown treesnake, masking of the flight sounds or foraging calls of predatory birds due to noise from proposed construction activities would not make eight-spot butterflies more susceptible to predation.

Fire potential would increase due to proposed live-fire range operations. Fire can result in direct effects to vegetation by increasing erosion, allowing for the establishment of non-native species, and altering wildlife habitat by reducing food resources, breeding habitat, and shelter. Native plants and their habitats on Guam are adapted to a humid, tropical climate and are not adapted to a fire driven ecosystem (USFWS 2008a).

As a BMP and in accordance with range safety protocols, a Range Fire Management Plan would be prepared, based on the DON's Wildland Fire Management Plan (Nelson 2008) (see Section 2.8). It would include protocols for monitoring fire conditions and adjusting training as needed (e.g., certain types of training may be disallowed under certain fire conditions), and location and management of firebreaks, fire-fighting roads, and a fire fighting water system. Units undergoing training would be briefed on requirements suitable to the conditions of the day and protocols should a fire occur (e.g., specifying how the range would shut down and how fire suppression action would be taken). With implementation of the Range Fire Management Plan, which establishes management and fire suppression and emergency response procedures, potential impacts from range-related wildfires would be less than significant. The USFWS concluded in their BO for the 2010 Final EIS that they anticipated that no additional vegetation

would be lost due to wildfires igniting as a result of proposed training operations (USFWS 2010a). Therefore, as operation of the range would not remove additional vegetation (e.g., host plants), there would be less than significant impacts to the Mariana eight-spot butterfly with implementation of proposed range operations under Alternative 5.

SERIANTHES TREE. The only known mature *Serianthes* tree on Guam is located on the northwest corner of the potential impacted area associated with the proposed MPMG Range (see Figure 5.5.8-2). To avoid any impacts to this tree, a minimum buffer of 100 feet (30 m) would be established around the tree and no activities would be permitted within this buffer. In addition, the DON will coordinate with the USFWS regarding access to the tree for research/conservation purposes. Therefore, there would be no impacts to *Serianthes* tree or recovery habitat with implementation of the proposed operations associated with Alternative 5.

Special-Status Species: Guam-Listed and SOGCN

Guam-listed species and SOGCN are also ESA-listed species and potential impacts to these species are discussed above.

5.5.9 Marine Biological Resources

5.5.9.1 Affected Environment

The description of the affected environment for marine biological resources around the proposed Alternative 5 is consistent with the summary provided for the proposed AAFB cantonment and housing Alternative C in Section 4.3.9.1. The primary difference in the affected environment between the NWF LFTRC and the Alternative C cantonment and housing location is that the Alternative C footprint is entirely onshore. SDZs for the proposed Alternative 5 extend offshore, into the Guam NWR - Ritidian Unit, which includes 401 acres (162 ha) of submerged lands at Ritidian Point from the high tide mark out to the 100-foot (30-m) bathymetric contour, lies offshore to the north (Figure 5.5.9-1).

5.5.9.2 Environmental Consequences

Construction

The environmental consequences for marine biological resources as a result of construction of Alternative 5 are consistent with the summary provided for the proposed AAFB cantonment/family housing alternative in Section 4.3.9.2.

There is no in-water construction work proposed for the construction of Alternative 5. Therefore, there are no anticipated direct impacts to marine resources. The measures used to minimize potential impacts from construction activities, including appropriate resource agency specific BMPs, construction and industrial permit BMPs (e.g., hooded lighting and limiting construction activities to daylight hours), USACE permit conditions, and general marine resources protective measures, are described in the 2010 Final EIS (Volume 7 and Volume 2, Chapter 11: Marine Biological Resources, Section 11.2: Environmental Consequences, pages 11-70 to 11-71) and summarized in Chapter 2 of this SEIS. Additional measures are described by NMFS to minimize impacts to EFH and ESA listed species as recommended conservation measures and are summarized under EFH and special status species in environmental consequences for operations below.

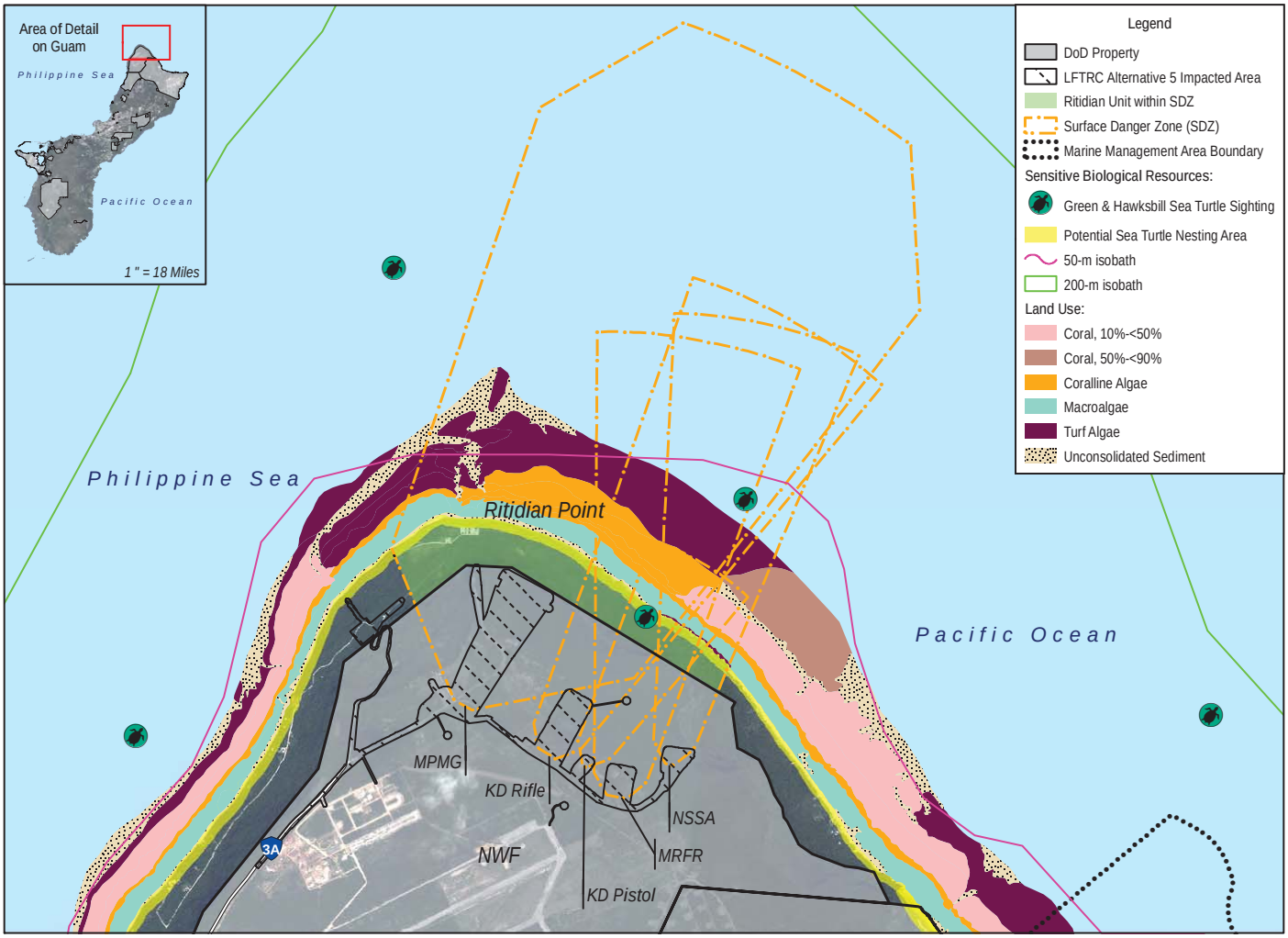


Figure 5.5.9-1
Overview of Sensitive Marine Biological Resources and Nearshore Habitat - NWF LFTRC Alternative 5

Increased recreational use of the marine resources near the Guam NWR - Ritidian Unit may occur via boat and beach accessible trails by construction workers. However, contract construction personnel would be issued base passes for official business only and these restrictions would be specified in construction contracts.

The DON would educate construction workers via environmental awareness training on the importance of coastal ecosystems and the proper way to interact with those resources to avoid and minimize damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities around Guam. The above measures would reduce indirect impacts by the construction workforce on marine resources to less than significant.

Operation

Potential impacts to marine biological resources as a result of operation of the proposed live-fire training ranges and associated range operation and control facilities at NWF are assessed below, but are generally as described in the 2010 Final EIS for the Route 15 alternatives (Volume 2, Chapter 11: Marine Biological Resources, Section 11.2.2.2: Central, pages 11-85 to 11-92).

For analytical purposes, a very small number of rounds fired at all proposed ranges would fall outside the range footprint, but within the SDZ. This is based on ricochets, not direct fire, meaning the speed of the bullet, and therefore the distance traveled, would be reduced after the bullet deflected off a surface.

The 2010 Final EIS described an analysis conducted using a combination of Marine Corps and Army methodology to determine the probability of direct strikes to a marine mammal, which found a very low likelihood that a projectile would come in contact with a dolphin (0.08524 dolphins per year), with an even lower possibility of imparting significant injury to the animal. Should munitions land in the water, the rapid sinking rate of such munitions is expected to preclude ingestion by marine organisms.

Scoping comments for this SEIS noted concern regarding the possibility that contamination could migrate from the ranges through stormwater runoff. However, as discussed in Section 5.2.2, Water Resources, there would be no impacts to nearshore waters due to implementation of surface water protection measures (i.e., compliance with Construction General Permit requirements and implementation of BMPs during construction and implementation of LID, range maintenance BMPs, and pollution prevention plans during operations).

In addition, erosion control, sediment runoff control, and spent munitions containment strategies would be implemented, and munitions and residue from range construction or use would remain on ranges to be treated and managed. Such munitions and residue would be treated and managed according to applicable DoD Directives and UFC requirements, as well as other measures being considered by the DON (as described in a manual titled "Prevention of Lead Migration and Erosion from Small Arms Ranges" [NAVFAC Pacific EV24SH, personal communication, April 26, 2013]). As discussed in Section 5.5.2, Water Resources, there would be no impacts to nearshore waters through implementation of surface water protection measures (i.e., implementation of LID, range maintenance BMPs, and pollution prevention plans during operations).

Marine Flora and Invertebrates

There would be no in-water training. Given the very limited quantity of bullets that would be deflected or ricochet off the bermed areas with enough residual energy to enter the marine environment and the BMPs described above, no impacts are expected to occur to marine flora and invertebrates as a result of the operation of the proposed LFTRC at NWF.

Fish

As previously discussed under Marine Flora and Invertebrates, the nominal quantity of bullets that would overshoot the bermed areas to enter the marine environment and the implementation of BMPs described above would result in less than significant direct impacts to fish as a result of LFTRC operational activities.

Essential Fish Habitat

As previously discussed under Marine Flora and Invertebrates, the nominal quantity of bullets that would overshoot the bermed areas to enter the marine environment and implementation of the BMPs described above would result in less than significant direct impacts to EFH from LFTRC operational activities.

Per the MSA, there would be no adverse effect on EFH because the proposed action would not reduce the quality or quantity of EFH as a result of LFTRC operational activities.

In accordance with the Magnuson-Stevens Fishery Conservation and Managament Act, the DON initiated informal consultation with the NOAA's NMFS Pacific Islands Regional Office, Habitat Conservation Division in May 2014 to determine the potential effects of construction and operations of DON's preferred alternatives (Alternatives E and 5) on EFH. NMFS reviewed the 2014 Draft SEIS on Guam and CNMI Military Relocation (2012 Roadmap Adjustments) and supplementary information provided by the DON during the course of the EFH consultation.

NMFS determined that adverse effects to EFH would occur unless recommended conservation measures were implemented. NMFS identified seven conservation recommendations to avoid and minimize impacts to EFH. The NMFS EFH effects determination letter of April 27, 2015 containing the complete list of recommendations and the DON's response to the determination letter are located in Vol. 2 Appendix F.5. NMFS' recommended conservation measures are summarized below.

- The DON should commit to ensure that the Northern Districe WWTP is upgraded to meet GWQS with an emphasis on orthophosphate, nitrate-nitrogen, and ammonia concentrations. The DON should encourage GWA to reduce nutrient levels even further as the GWQS are still above recommended levels of nitrate and orthophosphate discharges for coral reef habitats.
- The DON should, to the greatest extent practicable, minimize stormwater runoff and prevent increases in the amount of water discharged through freshwater seeps into nearshore coastal waters for each project component.
- The DON should further examine the fate of stormwater for these project components, particularly the Finegayan Cantonment and the NWF LFTRC, to determine whether stormwater practices affect sensitive nearshore reefs such as the HAPCs at Haputo ERA and the Ritidian Unit of the Guam NWR through seeps.
- The ROD should clearly identify funding and provide minimal guidelines for programs to minimize impacts from training, recreation, and fishing activities for Marine Corps personnel.
- Ensure that each Marine Corps unit assigned to Guam irrespective of duration and deployment status will institute a physical training awareness and operational guidance that identifies appropriate physical training areas as well as identify sensitive areas that are off-limits for such activities in coordination with installation and regional resource management plans.
- Develop methods to minimize fishing impacts by reducing take of fish species from key functional groups and rare species. This could include a ban for DoD personnel on use of destructive methods of fishing including for species of local concern such as humphead wrasse and green humphead parrotfish.

- The DON should provide a commitment to develop and implement a detailed and comprehensive Adaptive Management Plan that defines watershed management and erosion control mechanisms that will be adopted based on current best available information and involve a protocol articulating the framework to include assessing and mitigating cumulative impacts.

Special-Status Species

No explosive projectiles are proposed for use and all projectiles are expected to be contained within the range footprint by bullet traps or backstops, with the exception of ricochets, which would be contained within the SDZs, according to statistical analysis provided in the 2010 Final EIS. Signage as well as lighting (blinking red lights) would notify people in the area that the ranges are in use. However, the signage and lighting would be designed to insure minimal to negligible impacts on special-status species, primarily sea turtles. Therefore, there would be less than significant direct impacts to special-status species as a result of LFTRC operational activities.

On December 10, 2014, pursuant to section 7(a)(2) of the ESA, the DON requested informal consultation with NMFS Pacific Islands Regional Office regarding the effects of the proposed action on ESA-listed marine species: the threatened scalloped hammerhead shark and four species of threatened coral (*Acropora globiceps*, *Acropora retusa*, *Pavona diffluens*, and *Seriatopora aculeata*). Based on further consultation, the DON determined that only three of these recently listed species could occur in the vicinity of the proposed action and accordingly, the DON requested informal consultation to address potential effects to these newly listed species.

The DON requested informal consultation for two separate proposed action elements which may have the potential to affect either the scalloped hammerhead shark or the four species of threatened coral identified above:

- The effects of the projected increase of effluent from the Northern District WWTP outfall, a GWA facility.
- The effects of constructing the AVLA in Inner Apra Harbor.

The DON determined that the projected increase of effluent from the Northern District WWTP may affect, but is not likely to adversely affect *Acropora globiceps*, *Acropora retusa*, and *Seriatopora aculeata*, and the scalloped hammerhead shark because the effects are insignificant.

The AVLA includes a vehicle ramp which is the only in-water project not completed from the original 2010 EIS and associated ESA section 7 consultation with NMFS. The DON determined that the AVLA project may affect but is not likely to adversely affect the scalloped hammerhead shark because the effects are discountable.

At the request of NMFS, on April 13, 2015 the DON provided additional detailed information about the proposed action and potential conservation and mitigation measures (see Appendix F.5). Consultation with NMFS concluded with a letter of concurrence on May 18, 2015 (see Appendix F.5). NMFS considered the information in the DON's EIS/OEIS (2010), the Draft SEIS (2014), and consultation requests, as well as the best scientific information available about the biology and expected behaviors of the ESA-listed marine species and agreed with the DON conclusion that the proposed action is not likely to adversely affect the scalloped hammerhead shark or the ESA-listed corals.

NMFS also agreed that the proposed action would have no effect on critical habitat. NMFS provided in their letter of concurrence five conservation recommendations that they deemed prudent. The DON will

consider adoption of one or more of these conservation recommendations and will address them in the ROD for this proposed action.

Marine Conservation Areas

Range utilization would depend on the number of personnel required to complete annual individual training events, the duration of each event, and the training capacity of each range, but range availability for DoD training would be approximately 39 weeks per year with 13 weeks of non-availability for DoD training per year for weather, maintenance, and holidays. Alternative 5 operational activities would result in less than significant direct and indirect impacts to conservation efforts and management activities at the Guam NWR - Ritidian Unit with the implementation of BMPs and coordination between USFWS and the DON for current or planned research and conservation programs.

5.5.10 Cultural Resources

5.5.10.1 Affected Environment

The following discussion summarizes previous cultural resources studies, known historic properties, and other cultural resources within the PDIA and PIIA associated with Alternative 5. The Alternative 5 area, also known as the NWF alternative, is situated on the NWF section of AAFB and portions of the Ritidian Unit of the Guam NWR. The Ritidian Unit is owned and managed by the USFWS. Historically, portions of the area known as Tailalo underwent extensive development during and after WWII with the construction and use of NWF. The Ritidian area contains a substantial number of Pre-Contact and historic sites, with evidence of occupation potentially dating as early as 3500 years before present, as well as a Spanish mission, *latte* sites, and cave sites with pictographs (Carson 2012, 2014).

The affected environment for cultural resources associated with Alternative 5 is consistent with the affected environment description in the 2010 Final EIS (Volume 2, Chapter 12: Cultural Resources, Section 12.1.2.1: Andersen AFB, pages 12-9 to 12-16). This description of the affected environment is updated here with new information from recent archaeological and architectural investigations conducted for this SEIS and other projects. To determine whether site information is from previous investigations (such as the 2010 Final EIS or other cultural resource studies) or prepared during in-fill studies conducted for this SEIS, refer to dates in the reference column in each table for the archaeological sites.

Portions of the Alternative 5 PDIA and PIIA were investigated for the presence of cultural resources for the original proposed action (2010 Final EIS). Cultural resource investigations for the Final EIS and other previous investigations in the area included archaeological surveys (Grant *et al.* 2007; Church *et al.* 2009; Dixon and Walker 2011; Dixon *et al.* 2011b; Dixon *et al.* 2012), architectural inventories (Aaron *et al.* 2007), and TCP studies (Welch and Prasad 2006). Investigations at Ritidian have included intensive surveys (Dixon 2000) and excavations (Kurashina 1990; Olmo 1997; Bayman *et al.* 2010; Carson 2012, 2014; Jalandoni 2011). Additional investigations conducted for this SEIS included intensive cultural resource inventories in the PDIA and reconnaissance inventories in the PIIA (Dixon *et al.* 2015a, 2015b). Collectively, these investigations provide the comprehensive inventory of cultural resources for analysis in Alternative 5.

As described in Section 5.1.10.1, the HG Range would be located at Andersen South under all of the LFTRC alternatives. The entire area was previously surveyed at an intensive level (Welch 2010; Dixon *et al.* 2011a).

During October through December 2014, the DON consulted with the parties to the 2011 PA and the public on the Draft TRRA. Consistent with Stipulation V.C of the 2011 PA, the TRRA provided planning

level information on potential direct and indirect effects to historic properties within areas that may be selected in the Navy's ROD for the live-fire training range complex. The Draft TRRA included information on the locations, orientations, and designs of each proposed LFTRC location. In addition to receipt of written comments, DON cultural resources professionals conducted three consultation sessions with the parties to the PA to discuss the analysis. The DON will take all comments into account in preparing the Final TRRA, which is planned for publication shortly after this Final SEIS. Comments and considerations developed during the Draft TRRA consultation process have been incorporated in this Final SEIS and informed the Draft RMP, as required by Stipulation V.C.4 of the 2011 PA.

Cultural Resources in the Alternative 5 PDIA

Alternative 5 would involve the construction of individual ranges, support buildings, towers, access roads, and the relocation of the USFWS facilities at the Ritidian Unit of the Guam NWR. The PDIA consists of the limits of proposed construction.

Table 5.5.10-1 lists 35 known archaeological sites located within the Alternative 5 PDIA on AAFB and the Ritidian Unit of the Guam NWR. Twenty sites, including artifact and ceramic scatters, a rock alignment, a rock shelter, the Ritidian Site Complex, and NWF (a historic airfield) are eligible for listing in the NRHP.

Fifteen sites, consisting of disturbed Pre-Contact ceramic scatters and historic WWII sites, are not eligible for listing in the NRHP. Should this alternative be selected, archaeological sites that cannot be avoided would be evaluated following the procedures in the 2011 PA. No historic properties have been identified in the PDIA for the proposed HG Range at Andersen South.

Table 5.5.10-1. Archaeological Sites within the Alternative 5 PDIA

GHPI Number[1]	*Temporary Site Number/ Map Number*	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-0012	T-RIT-100	Ritidian Site Complex[2]	Pre-Contact/ Latte/ Spanish Missionization/ Chamorro Spanish Wars	Reinman 1977	Yes	D
66-08-1065***		Airfield[2]	Pre-Contact/Latte, Post-WWII/ Second American Territorial	Aaron *et al.* 2007; Dixon *et al.* 2011b	Yes	D
66-08-2492	T-A3-1	Rock shelter with midden soil and marine shell[2]	Pre-Contact/Latte	Dixon *et al.* 2011b	Yes	D
66-08-2493	T-NW-1	Artifact scatter	Organic Act/Home Rule/Economic Development	Dixon and Walker 2011	No	NA
66-08-2494	T-NW-2	Artifact scatter[2]	Pre-Contact/Latte	Dixon and Walker 2011	Yes	D
66-08-2495	T-NW-3	WWII-era fuel tank farm (tanks removed) [2]	WWII (Unspecified)	Dixon and Walker 2011	No	NA
66-08-2496	T-NW-5	Ceramic scatter[2]	Pre-Contact/Latte	Dixon and Walker 2011	Yes	D
66-08-2503	T-M-01	Concrete pad	Post-WWII/ Second American Territorial	Dixon *et al.* 2012	No	NA

Table 5.5.10-1. Archaeological Sites within the Alternative 5 PDIA

GHPI Number[1]	*Temporary Site Number/ Map Number*	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-2505	T-M-03	Dump[2]	Post-WWII/Second American Territorial	Dixon *et al.* 2012	No	NA
66-08-2506	T-M-04	Concrete pad and foundation[2]	Post-WWII/Second American Territorial	Dixon *et al.* 2012	No	NA
66-08-2507	T-M-05	Concrete pad, wooden power poles[2]	Post-WWII/Second American Territorial	Dixon *et al.* 2012	No	NA
66-08-2508	T-M-06	Cobble walls[2]	Pre-Contact/Latte	Dixon *et al.* 2012	Yes	D
66-08-2522	T-RP-01	Ceramic scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2012	Yes	D
66-08-2523	T-RP-02	Concrete foundations and cobble retaining wall (remains of lighthouse/ beacon)[2]	WWII Japanese Military Occupation, Post-WWII/Second American Territorial	Dixon *et al.* 2012	No	NA
66-08-2530	T-PP-01	Artifact scatter[2]	Pre-Contact/Latte	Dixon *et al.* 2012	Yes	D
	T-NW- 4	Ceramic scatter	Pre-Contact/Latte	Dixon and Walker 2011	Yes	D
	T-NW-9	Artifact scatters[2]	Pre-Contact/Latte, Post-WWII/Second Territorial	Dixon and Walker 2011	Yes	D
	T-NW-10	Artifact scatter (possible helicopter components)	Organic Act/Home Rule/Economic Development	Dixon and Walker 2011	No	NA
	T-NW-16	Artifact scatter	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
	T-NW-18	Ceramic scatter	Pre-Contact/Latte	Dixon and Walker 2011	Yes	D
	T-NW-19	Ceramic scatter	Pre-Contact/Latte	Dixon and Walker 2011	Yes	D
	T-NW-20	Artifact scatter[2]	Pre-Contact/Latte	Dixon and Walker 2011	Yes	D
	T-NW-21	Ceramic scatter[2]	Pre-Contact/Latte	Dixon and Walker 2011	Yes	D
	T-NW-24	Ceramic scatter[2]	Pre-Contact/Latte	Dixon and Walker 2011	Yes	D
	T-NW-25	Artifact scatter[2]	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
	T-NW-26	Ceramic scatter[2]	Pre-Contact/Latte	Dixon and Walker 2011	Yes	D
	T-NW-39	Ceramic scatter[2]	Pre-Contact/Latte	Dixon and Walker 2011	Yes	D
	T-NW-40	Ceramic scatter[2]	Pre-Contact/Latte	Dixon and Walker 2011	Yes	D
	FTX3-2	Artifact scatter	Pre-Contact/Latte	Church *et al.* 2009	Yes	D

Table 5.5.10-1. Archaeological Sites within the Alternative 5 PDIA

GHPI Number[1]	*Temporary Site Number/ Map Number*	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-08-2731	Site 3	Ceramic scatter, bottle dump	Pre-Contact/Latte Post-WWII/Second American Territorial	DeFant 2014	Yes	D
66-08-2736	T-NWF-001a	Road bed	Post-WWII/Second American Territorial	Dixon *et al.* 2015a	No	NA
66-08-2737***	T-NWF-001b	Artifact scatter	Post-WWII/Second American Territorial	Dixon *et al.* 2015a	No	NA
66-08-2738	T-NWF-002	Artifact scatter	Pre-Contact/Latte	Dixon *et al.* 2015b	No	NA
66-08-2744	T-RIT-105	Ceramic scatter	Pre-Contact/Latte	Dixon *et al.* 2015a	No	NA
66-08-2753	T-RIT-120	Ceramic scatter	Pre-Contact/Latte	Dixon *et al.* 2015a	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable. NRHP criterion D = eligible for potential to yield information important in prehistory or history.

Notes: [1]Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

[2]Sites are in both the PDIA and the PIIA.

** Revised to match Guam GHPI forms dated May 28, 2014.

*** The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated August 12, 2014 [RC2013-0904]).

No TCPs have been identified in the PDIA for this alternative (Welch and Prasad 2006; Griffin *et al.* 2010).

Cultural Resources in the Alternative 5 PIIA

The PIIA consists of the area within the SDZs for the LFTRC and HG ranges and associated areas potentially affected by increases in noise. Table 5.5.10-2 summarizes the 79 known archaeological sites located within the Alternative 5 PIIA. There are 60 known NRHP-eligible sites in this area, including the Ritidian Site Complexes (GHPI Numbers 66-08-0012 and 66-08-0013), a portion of the Jinapsan site (GHPI number 66-08-0014), artifact scatters, NWF, and rockshelters. One of the Ritidian Site Complexes is also located within the PDIA. The remaining 19 sites, which include a WWII-era fuel tank farm and a historic site with concrete foundations and a cobble retaining wall, are not eligible for listing in the NRHP. Three structures associated with the FWS are located within the PIIA. None of these structures are eligible for listing in the NRHP. No TCPs have been identified in the PIIA for Alternative 5. Natural resources of cultural importance may occur in this area.

Table 5.5.10-2. Summary of Archaeological Sites Known to be Located within the Alternative 5 PIIA

Site Type	*Period***	*Number of Sites of this Type in the Impact Area*	*NRHP Eligible?*	*NRHP Criteria*
Complex[1]	Pre-Contact/Latte, Spanish Missionization/ Chamorro Spanish Wars	3	Yes	D
Pre-Contact Artifact/Ceramic Scatters	Pre-Contact/Latte	40	Yes	D
Pre-Contact Ceramic Scatters	Pre-Contact/Latte	2	No	NA
Cobble Wall	Pre-Contact/Latte	2	Yes	D
Rockshelters/Caves	Pre-Contact/Latte	8	Yes	D
Artifact Scatter/Dumps	Post-WWII/Second American Territorial	7	No	NA
Artifact Scatter	Post-WWII/Second American Territorial	1	Yes	NA
Artifact Scatter	WWII (unspecified)	1	No	NA
Fuel Tank Farm (tanks removed)	WWII (Unspecified)	1	No	NA
Concrete Pad	Post-WWII/Second American Territorial	3	No	NA
Road Bed/Tank Trail	WWII (unspecified)	1	No	NA
Concrete Foundations and Cobble Retaining Wall	WWII Japanese Military Occupation, Post-WWII/ Second American Territorial	1	No	NA
Mixed Component Ceramic Scatter, Concrete Pad, and Artifact Scatter	Pre-Contact/Latte, Post-WWII/Second American Territorial	1	No	NA
Mixed Component Ceramic Scatter and Artifact Scatter	Pre-Contact/Latte, Post-WWII/Second American Territorial	2	Yes	D
Firing Range Embankment	WWII (unspecified)	1	No	NA
Defensive positions	WWII Japanese Military Occupation	3	Yes	D
Antenna Base	Post-WWII/Second American Territorial	1	No	NA
Airfield	Post-WWII/Second American Territorial	1	Yes	D

Legend: NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion D = eligible for potential to yield information important in prehistory or history.
Notes: [1]One of these sites is in both the PDIA and the PIIA
** Revised to match Guam GHPI forms dated May 28, 2014.

5.5.10.2 Environmental Consequences

Construction

Construction activities associated with Alternative 5 may adversely affect historic properties and impact culturally important natural resources. Final determinations of effect would follow the procedures in the 2011 PA. Following is a discussion of potential direct and indirect adverse effects to historic properties and impacts to culturally important natural resources.

Construction of the ranges, support facilities, utilities, and road construction would primarily occur in the NWF area of AAFB (see Figure 2.5-6). However, the construction of an access road and a vehicle access gate would occur on the Ritidian Unit of the Guam NWR and could adversely affect site 66-08-0012. Given the substantial development anticipated in the PDIA, it is assumed for purposes of this analysis that 100% of the area would be disturbed. Nevertheless, design alternatives to avoid and minimize adverse effects would be considered, consistent with procedures in the 2011 PA. No construction is proposed in the PIIA. Excavation and soil removal associated with the construction of Alternative 5 could adversely affect 20 known historic properties, including Pre-Contact artifact scatters and sites containing *latte* components (see Table 5.5.10-1). Fourteen of the historic properties are located within both the PDIA and the PIIA. Direct impacts to these sites would only occur to the portion within the PDIA.

Under Alternative 5, the Guam NWR administrative offices would be relocated to the southwest. The existing Guam NWR buildings, which are not considered eligible for listing in the NRHP, would be left in place.

Construction activities associated with Alternative 5 have the potential to directly impact culturally important natural resources. The project would require the removal of limestone forest where culturally important natural resources, including traditional plants, may be present. The 2011 PA contains measures for coordinating with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners and traditional artisans regarding identification and disposition of these important resources prior to construction (see 2010 Final EIS, Volume 2: 2-10; Volume 9, Appendix G, Chapter 4).

No historic properties or culturally important natural resources are anticipated in conjunction with utility upgrades that would be associated with Alternative 5. The modification or replacement of existing overhead electrical lines under Alternative 5 would not affect any known cultural resources. Water and wastewater utilities would be placed along Perimeter Road and on a new access road. There are no known NRHP-eligible sites or structures located in the areas planned for water or wastewater utility upgrades. No adverse effects to historic properties are anticipated in conjunction with these utility upgrades.

There are no historic properties located in the PDIA or the PIIA for the proposed HG Range at Andersen South. Therefore, no adverse effects to historic properties are anticipated due to construction of the HG Range.

Operation

Operations associated with Alternative 5 could cause indirect adverse effects to historic properties as discussed below. Final determinations of effect would follow the procedures in the 2011 PA. Following is a discussion of potential adverse effects of operations associated with Alternative 5.

The potential for direct effects within the SDZ would be limited to the risk of strikes from stray rounds during Alternative 5 operations. The risk of such effects occurring is extremely low. The range would be designed to contain live fire inside the range itself to minimize the probability of rounds landing in the SDZ. The natural terrain would also serve to prevent direct effects in the SDZ, because the culturally sensitive areas within the Alternative 5 SDZs are substantially lower in elevation than the site of the range. Additionally, if a stray round were to escape the range, the chance of it hitting a historic property is remote, given the size of the SDZ and dispersal of historic properties. For these reasons, the potential for direct adverse effects as a result of range operations is *de minimis*.

Indirect adverse effects to NRHP-eligible archaeological sites from the operation of Alternative 5 could result from changes affecting site integrity. For many types of archaeological sites (e.g., ceramic scatters, rock alignments), auditory impacts associated with live-fire operations would not affect characteristics

that qualify them for the NRHP. An increase in noise associated with live-fire operations may adversely affect historic properties for which solitude, quiet, or contemplation contribute to or define their significance, such as TCPs.

Areas near the ranges are currently subject to intermittent noise from aircraft up to 60 dB DNL, although most areas currently have average noise levels of less than 60 dB DNL (see Section 5.5.4, Noise). Under Alternative 5, small arms live-fire noise would be audible near 46 NRHP-eligible sites that are located within the expanded noise contours (Table 5.5.10-3). Average noise levels during range operations are projected to increase from current levels of less than 60 dB to between 65 dB and 85 dB ADNL due to the introduction of small arms live-fire noise. At the Ritidian Unit of the Guam NWR, noise levels are projected to increase from current levels of less than 60 dB to over 80 dB ADNL in some areas, although some attenuation below the cliffline is expected due to topography. Forty-two NRHP-eligible sites are Pre-Contact artifact scatters, rockshelters, historic military sites, and a portion of NWF (66-08-1065). Three NRHP-eligible sites have multiple *latte* components and one NRHP-eligible site is a cave site.

Table 5.5.10-3. Summary of Archaeological Sites Potentially Affected by Noise

Site Type	*Period***	*Number of Sites of this Type in Impact Area*	*NRHP Eligible?*	*NRHP Criteria*
Latte Sites/Complexes	Pre-Contact/Latte	3	Yes	D
Pre-Contact Cave	Pre-Contact	1	Yes	D
Pre-Contact Artifact Scatters	Pre-Contact	33	Yes	D
Rockshelters	Pre-Contact/Latte	4	Yes	D
Historic Artifact Scatter	Post-Contact	1	Yes	D
WWII Defenses	WWII Japanese Military	3	Yes	D
NWF (Site 66-08-1065)	Post-WWII/Second American Territorial	1	Yes	D

Legend: NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion D = eligible for potential to yield information important in prehistory or history.
Note: ** Revised to match Guam GHPI forms dated May 28, 2014.

Based on the analysis, changes in the setting would not indirectly adversely affect the integrity of 43 NRHP-eligible artifact scatters, rockshelters, or historic military sites. However, three potentially noise-sensitive NRHP-eligible sites with *latte* components and cave sites with pictographs could be indirectly adversely affected by substantial changes in the audible environment. Final determinations of effect would follow the procedures in the 2011 PA.

As indicated in Section 5.5.11, indirect adverse effects from visual intrusions associated with Alternative 5 would be minimal as the ranges are within an existing military operations area and the action would not involve a change in visual setting.

Access within the SDZs would be restricted during range operations. Cultural sites located on AAFB currently have limited access due to operations. Portions of the Ritidian Unit of the Guam NWR are currently open to the public. Portions of two NRHP-eligible archaeological sites, the Ritidian Site Complexes (66-08-0012 and 66-08-0013), are located within the SDZs that overlay portions of the Ritidian Unit. Portions of these sites are accessible to the public through tours and public education programs and are part of on-going scientific research programs. Under Alternative 5, access to these sites would be restricted while the ranges are in use. Access to these sites during those periods when the ranges are not in use is a matter under the management authority of the USFWS. Restricted access associated with operation of Alternative 5 would be a significant impact.

Summary of Impacts and Potential Mitigation Measures

Implementation of Alternative 5 could cause direct adverse effects to 20 known NRHP-eligible archaeological sites. Potential indirect adverse effects could occur to three NRHP-eligible archaeological sites. Potential impacts could also occur to two NRHP-eligible sites (GHPI Numbers 66-08-0012 and 66-08-0013), as a result of reduced access. In addition, culturally important natural resources could be directly impacted due to removal of limestone forest. Under this alternative, there would be more adverse effects from construction at NWF than any of the other LFTRC alternatives. There would be more adverse effects from operations under Alternative 5 than under any of the other alternatives. Refer to Section 5.7, Table 5.7-1 for a comparison of cultural resources impacts and potential mitigation measures for each LFTRC alternative.

The 2011 PA, as discussed in Section 3.1.2, establishes a program alternative for complying with NHPA Section 106 requirements. Broadly, the 2011 PA includes processes to share information, consider views of the public, and develop mitigation measures when historic properties may be adversely affected. The 2011 PA provides measures for mitigating adverse effects to NRHP-eligible or listed archaeological sites, consulting on new projects and initiating additional identification efforts, and resolving impacts due to loss of access to potential TCPs or culturally important natural resources.

More specifically, the 2011 PA established a process for the review and analysis of potential effects to historic properties and other cultural resources for all alternative LFTRC locations. During October through December 2014, the DON consulted with the parties to the PA and the public on the TRRA, which provided information about cultural resources potentially affected by the LFTRC alternatives carried forward in the SEIS, consistent with PA Stipulation V.C. The TRRA provides information on potential adverse effects resulting from the construction and operation of the LFTRC alternative to support consultation with the PA parties and the public. The DON will take all comments into account before reaching a final decision. For any alternative selected in the ROD, the 2011 PA stipulates that a RMP will be prepared to address effects from the construction and operation of the ranges. The RMP, developed in consultation with the consulting parties, will stipulate measures to avoid, minimize, and mitigate adverse effects to historic properties.

To the degree possible, impacts to historic properties and natural resources of cultural importance would be avoided or minimized during the planning process. Consultation under the 2011 PA would address potential adverse effects and alternatives to avoid adverse effects. Refer to Section 3.10 for more information on definitions and procedures. If avoidance is not possible, Table 5.5.10-4 presents potential mitigation measures to resolve adverse effects to historic properties and reduce impacts to cultural resources resulting from the implementation of Alternative 5. With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that direct and indirect, short- and long-term impacts would be reduced to a level below significance in all but one instance. Loss of access to the Ritidian Site Complexes, as they are currently accessible to the public daily, would remain a significant impact under NEPA with reduced accessibility by the public. The DON would pursue an agreement with USFWS in accordance with the provisions of Section 2822 of the FY 2015 NDAA, which would allow for the continued management of the Ritidian Unit consistent with the purposes for which it was established and the operation of the range SDZs associated with the LFTRC preferred alternative at NWF. The DON anticipates that access restrictions will be addressed in this agreement.

Table 5.5.10-4. Potential Mitigation Measures for Alternative 5 for Adverse Effects (NHPA) and Impacts to Other Cultural Resources (NEPA)

NHPA Effects	***Mitigation***
Potential direct adverse effects to 20 historic properties-NRHP-eligible archaeological sites from construction and potential indirect adverse effects to three NRHP-eligible sites from changes in use that degrade site integrity.	Development and implementation of the RMP to identify specific measures to avoid, minimize, and mitigate direct and indirect adverse effects to historic properties.
NEPA Impacts	***Mitigation***
Potential adverse impacts to two NRHP-eligible archaeological sites from restricted access.	Consideration of options for access that considers public interest, public safety, and installation security for access to these culturally sensitive locations.
Potential impacts to culturally important natural resources.	Through the 2011 PA process, coordinate with the SHPO and concurring parties to contact traditional natural healers, herbal practitioners, and traditional artisans to provide an opportunity to collect these resources consistent with installation security instructions and safety guidelines prior to construction.

5.5.11 Visual Resources

5.5.11.1 Affected Environment

A list and description of visual resources at NWF are provided in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.1.1.1: Andersen AFB, pages 13-1 to 13-8). NWF, located in the northwestern sector of AAFB, contains several old runways within a setting of dense tropical vegetation. The landscape is heavily vegetated, dominated by wide-canopy trees and shrubs that generally block long-distance views. Along the adjacent coastline lie several scenic points of interest that provide recognized scenic and recreational value, such as Ritidian Point and Uruno Point. The views at Ritidian Point and Uruno Point are discussed in the 2010 Final EIS (Volume 2, Chapter 13: Section 13.1: Affected Environment, Section 13.1.1.3, Andersen AFB, page 13-15). Photo 5.5.11-1 shows the view of Alternative 5 from Route 3A.



Photo 5.5.11-1: View of Route 3A descending to the Guam NWR Nature Center at Ritidian Point-NWF (View of Alternative 5 location in the upper-half of the photo)

Source: AECOM 2010c

5.5.11.2 Environmental Consequences

Construction

During construction, activities and equipment would temporarily cause view obstructions where recognized views currently exist. The short-term direct visual impacts during the construction phase would be less than significant.

Operation

As discussed in the 2010 Final EIS (Volume 2, Chapter 13: Visual Resources, Section 13.2.2.1: North, pages 13-262 to 13-267), development of land adjacent to Route 3A for a live-fire training range would result in minor alteration of the existing visual landscape. Although Route 3A is accessible to the public, the surrounding land is federal property and is closed to the public. Accessible views into these areas are limited because of the relatively flat topography of the plateau and substantial vegetation along the roadway. The affected areas are mostly grass and are adjacent to the NWF airfield. The Ritidian Point overlook located immediately adjacent to Route 3A before the road begins its descent along the cliff slopes is at a lower elevation than the nearby development at NWF and the views from this area would not be affected by development. Because of the amount of clearing and development for Alternative 5, as well as the lack of publicly accessible views into the area, the long-term direct impact on visual resources would be less than significant.

Alternative 5 would have less of an impact to visual resources than Alternatives 1, 3, and 4, and a similar level of impact compared to Alternative 2.

5.5.12 Ground Transportation

5.5.12.1 Affected Environment

The affected environment for ground transportation resources associated with the Alternative 5 includes transportation facilities internal to the site (range roadways and intersections). This section discusses existing conditions and assesses how construction and operations of Alternative 5 would potentially affect transportation conditions for roadways and intersections internal to the site. Impacts to off-base (external) roadways and intersections are summarized in Section 6.1 of this SEIS.

5.5.12.2 Environmental Consequences

Construction

Potential construction impacts to ground transportation under Alternative 5 would be the same as those discussed in Section 4.2.12.2 for Alternative A. Potential direct and indirect impacts to ground transportation resources from construction would be minimized with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, there would be less than significant short-term impacts to on-base (internal) roadways.

Operation

Proposed entry to Alternative 5 would be via Route 3A. The existing roadway and gate area would be improved to support LFTRC traffic and an Entry Control Facility would be constructed to control access during hours of operation. Secondary access would be provided on existing roads in the NWF complex. Approximately 5 miles (8 km) of roads would be improved or constructed to support LFTRC traffic. Potential operational impacts for Alternative 5 would be the same as those described in Section 5.1.12.2 for Alternative 1; and there would be no direct, long-term significant impacts to internal (range) roadway segments or intersections.

5.5.13 Marine Transportation

5.5.13.1 Affected Environment

The location and orientation of Alternative 5 would result in an SDZ that encompasses an area of approximately 3,059 acres (1,238 ha) of the Philippine Sea off the northern coast of Guam. In addition, the Alternative 5 SDZ would encroach on a designated shipping lane used by all vessels traveling directly from Hawaii to Guam. The encroachment would obstruct a near-shore portion of the lane, extending approximately 2 miles (3 km) from the shoreline.

5.5.13.2 Environmental Consequences

The area of the SDZ will be closed to all vessel traffic on an intermittent basis, following 33 CFR 334, to allow uninterrupted training. The temporary nature of the closure and the location of the SDZ minimal distance from the shoreline would result in a less than significant impact on marine transportation.

In order to ensure that vessels are not at risk of accidentally entering the SDZ and being struck by projectiles from the firing ranges, designated military personnel, trained in the use of sighting equipment, would observe the SDZ and nearby waters for vessel traffic. Two proposed Range Observation Towers would give observers an unobstructed view to survey the SDZ for vessels before and during live-fire exercises. Live-fire training would cease if a vessel entered the SDZ and resume only when the SDZ was cleared. Cessation of live fire via observer notice would mitigate the risk of a vessel being struck by projectiles. The SDZ area would be identified on nautical charts, but will not be physically marked on the ocean surface. Standard operating procedures would be implemented to notify mariners of training activities and ensure that the SDZ is cleared of vessels prior to live-fire training.

An aid to navigation at Ritidian Point (Figure 5.5.6-1) is within the resulting SDZ of Alternative 5; however, there is a low risk of impact from projectiles from the LFTRC due to the angle from the range orientation. The aid to navigation would be to the west of the range control tower.

5.5.14 Utilities

5.5.14.1 Affected Environment

Existing utilities in the vicinity of the proposed HG Range are the same as discussed in Section 5.1.14.1 for Alternative 1.

Electrical Power

The electrical utility near the proposed Alternative 5 consists of the existing local DoD 3-phase 13.8 kV overhead power distribution system serving the NWF, including the Rapid Engineer Deployable Heavy Operational Repair Squadron Engineers facilities and existing USFWS facilities.

Potable Water

The potable water system near Alternative 5 includes elements of the DoD water transmission and distribution system. This existing functioning system consists of underground water lines and manholes serving the Rapid Engineer Deployable Heavy Operational Repair Squadron Engineers facilities at NWF, which is supplied by existing Well AF-5. The DoD water distribution system is typically 8-inch (20-cm) diameter buried pipe.

The existing USFWS facilities utilize a water catchment system with an on-site treatment system, supplemented with water tank trucks, as needed.

Wastewater

The wastewater utility near Alternative 5 consists of a buried wastewater collection system serving the Rapid Engineer Deployable Heavy Operational Repair Squadron Engineers facilities on AAFB. This system has an 8-inch (20-cm) diameter sewer along Perimeter Road. There is currently no wastewater collection system in the immediate vicinity of this alternative.

The existing USFWS facilities currently utilize septic tanks with leachfield systems.

Solid Waste

There are no solid waste facilities near Alternative 5.

Information Technology and Communications

There is no DoD IT/COMM infrastructure in the immediate vicinity of LFTRC Alternative 5.

5.5.14.2 Environmental Consequences

Electrical Power

The proposed electrical system improvements for Alternative 5, as described in Sections 2.5.4.5 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The long-term electrical power requirements of the LFTRC facilities would be small (less than 50 kW), and thus have minimal direct impact on the current system or current power customers. During construction, current users could experience short-term minimal power outages. With careful planning, these potential outages would be minimized.

The short- and long-term, direct impact of Alternative 5 on the electrical utility would be less than significant, during both construction and in operation.

Potable Water

The proposed water system improvements for Alternative 5, as described in Sections 2.5.4.5 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The Range Maintenance Building and the KD Rifle/KD Pistol Range Administrative Building are the only LFTRC facilities requiring water service. A fire hydrant would also be provided for filling range fire fighting vehicles and general fire protection. The proposed LFTRC water supply would serve the Range Maintenance Building and the KD Rifle/KD Pistol Range Administrative Building. The long-term potable water demand of the LFTRC would be small, estimated at an average daily demand of 26,520 gallons per day (100,389 liters per day). Therefore, less than significant long-term direct impact would occur to the current DoD system. The relocated USFWS facilities would continue to receive potable water from their catchment and on-site treatment system. There would be no impact on the potable water resource from relocation of the USFWS facilities. During construction, short-term, minor water service outages. With careful planning, these potential outages would be minimized.

The short- and long-term, direct impact from LFTRC Alternative 5 to the potable water utility would be less than significant, both during construction and operations.

Wastewater

The proposed wastewater collection system improvements for Alternative 5, as described in Sections 2.5.4.5 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The only LFTRC facility requiring sewer service would be the Range Maintenance Building and the KD Rifle/KD Pistol Range Administrative Building, that have an estimated wastewater

flow of less than 0.01 MGd (0.038 MLd). Due to the remote location and low volume of wastewater flow, the wastewater system would consist of gravity sewer line, septic tank, and effluent disposal basin. Design of septic tank would be in accordance with GEPA Toilet Facilities and Sewage Disposal Guidelines. Design of an effluent disposal basin would be in accordance with Manual for Constructed Wetland and Aquatic Plant Systems for Municipal Wastewater Treatment, and be acceptable to GEPA. The design would be similar to alternative sewer design used in the North Gate project. The sewage would be designed to pass from the buildings into septic tanks where it would be pumped into a self-contained effluent disposal facility. The liner would be designed to keep the effluent from entering groundwater and to keep the rainwater from flooding the field and washing the effluent into the environment. Three layers of material, course rock, sand, and soil would be contained within the disposal area. The soil and sand would be designed to create a growing environment for the plants. The rock would be designed to be a conveyance system for the effluent to spread through the area of the facility. The long-term estimated wastewater demand for these facilities is small and there would be no direct impact on the existing sewer collection or treatment systems.

All other LFTRC facilities, including the HG Range, would be provided with portable toilets. These toilets would require periodic emptying, with the sewage taken to one of the existing WWTPs for treatment. The estimated sewage amount is minimal and would not have a long-term, direct impact on the current wastewater resource.

The relocated USFWS facilities could be serviced for wastewater by three options: (1) a sewer line with a surge holding tank (in case of power outage) and a series of five pump stations to overcome the large elevation difference between the facilities, as well as the existing sewer line servicing the Rapid Engineer Deployable Heavy Operational Repair Squadron Engineers facilities, (2) a holding tank requiring periodic emptying with the wastewater being taken to the North District WWTP, or (3) a new septic tank constructed adjacent to the relocated facilities. Option 3 was ruled out due to concerns regarding impact to the NGLA. Option 1 or 2 are viable, with Option 2 having a reduced estimated capital cost. With either Option 1 or 2, the estimated wastewater flow from the USFWS facilities is small and would have only a minimal long-term, direct impact on the current sewer system by slightly increasing the amount of flow.

Any outages to service during construction would be short-term and minimal by doing tie-in work at low flow times, providing bypass lines and pumps, and by careful planning and design of the tie-in methods.

The current wastewater systems planned to be utilized by LFTRC Alternative 5 would be impacted minimally by this proposed action. Thus, the short- and long-term, direct impact from LFTRC Alternative 5 to the wastewater utility would be less than significant during both construction and operations.

Solid Waste

The proposed solid waste infrastructure improvements for Alternative 5, as described in Sections 2.5.4.5 and 2.5.4.6 (for HG Range), have been developed to meet the requirements for the proposed action. The estimated solid waste generation for LFTRC operations is small and this long-term additional solid waste would not directly impact current waste collection, handling, or disposal operations. Suitable solid waste collection containers would be provided where required. The solid waste would be periodically collected, handled, and disposed by contractors or DoD personnel already serving the NWF.

There would be a short-term, direct impact to the solid waste handling effort during the U&SI construction, involving the generation of green waste following the clearing and grubbing of the range areas and roads, as well as generation of C&D debris waste during construction. The U&SI contractor would be required to process the generated green waste as part of their assigned contract requiring 100% diversion of the green waste into mulch (trees and stumps) and compost (leaves and grass), and 60% minimum diversion of C&D debris waste. The DON subject matter experts will review the U&SI's contractor's green waste processing and composting facility operations plan to ensure that it meets industry and regulatory standards. The U&SI contractor will be responsible for obtaining the solid waste facility permit issued by GEPA prior to commencing activities.

The C&D debris and green wastes that cannot be recycled or reused, as well as wastes that are prohibited at Layon Landfill would be disposed at the Naval Base Guam Landfill, subject to ongoing discussions between the DON, USEPA, and GEPA, and permitted private hardfill facilities. The DON proposes to explore ways to resolve key solid waste issues, specifically the status of the Naval Base Guam Landfill permit and handling of special wastes not accepted at Layon Landfill, through the Solid Waste Working Group that was established with USEPA and GEPA on July 24, 2014. During the September 19, 2014 meeting of the Solid Waste Working Group, GEPA indicated that they will formally respond to DON correspondence with regards to issues relative to the Naval Base Guam Landfill. The Layon Landfill and the permitted private hardfill facilities are operating within their regulatory requirements. The proposed action would be in compliance with all applicable GEPA solid waste permit terms and conditions that routinely include specific measures to protect human health and the environment. All other projects on Guam would utilize permitted solid waste management and disposal facilities.

The short- and long-term, direct impact of Alternative 5 on the solid waste facilities would be less than significant, during both construction and operations.

Information Technology and Communications

The proposed IT/COMM infrastructure improvements for Alternative 5 as described in Section 2.6 have been developed to meet the requirements for the proposed action. Since there are no existing IT/COMM resources in the immediate vicinity of this LFTRC alternative, there would be no direct, long-term impact on existing IT/COMM services. Alternative 5 would require installation of new conduit duct banks consisting of six 4-inch (10-cm) conduits for interconnecting the LFTRC range facilities, including the HG Range. There would also be inter-base connectivity required for DoD IT/COMM, as discussed in Section 2.6. Installation of these IT/COMM lines could cause short-term, temporary service disruptions to current IT/COMM users. With careful planning, these potential disruptions would be minimized.

The short- and long-term, direct impact of Alternative 5 to the IT/COMM utility would be less than significant during both construction and operation.

5.5.15 Socioeconomics and General Services

5.5.15.1 Affected Environment

Most issues and impacts associated with socioeconomics and general services encompass the entire proposed action (i.e., cantonment/family housing and LFTRC development, increased population), and do not vary with site alternatives. Accordingly, the impact discussion in Section 4.1.15 of this SEIS applies for all of the LFTRC alternatives and is incorporated here by reference. Land acquisition, however, is unique to the LFTRC alternatives, and the amount of land to be acquired varies by alternative. Therefore, this section focuses exclusively on the socioeconomic and sociocultural issues and impacts associated

with the acquisition of land under Alternative 5 (with the exception of the HG Range, which would not require land acquisition).

5.5.15.2 Environmental Consequences

Socioeconomic and Sociocultural Impacts

Sociocultural impacts associated with land acquisition are less tangible and are conceptual frameworks such as social disarticulation and cultural marginalization (the deterioration of social structures, networks, or belief systems), and social and psychological marginalization, stress, and anxiety (a person's loss of confidence in society and themselves, feelings of injustice, and reduced social status). See Appendix D, Section 5.2.2 for more detail.

Alternative 5 would not require federal land acquisition. Custody and control of 268 acres (108.5 ha) would be reassigned from DOI to DoD, and some areas that are currently accessible to the public would become restricted access areas. New restrictions on public access to the land and submerged lands encumbered by the NWF LFTRC could have long-term indirect adverse sociocultural impacts due to the potential that access restrictions to subsistence fishing and recreation areas would deteriorate social networks (i.e., if groups of people currently [or traditionally] use areas that would be restricted to hold social gatherings, then the access restrictions could impact those groups by deteriorating the social networks inherent in those groups). Also, as social networks may deteriorate due to the access restrictions, feelings of injustice may arise. While there is potential for social networks to deteriorate, it is not a certainty. Given the presence of other public recreation areas nearby, potential impacts are determined to be less than significant.

5.5.16 Hazardous Materials and Waste

5.5.16.1 Affected Environment

The current DoD ROI on Guam for hazardous materials and waste in this section includes the Air Force property proposed for development of the LFTRC. Air Force property includes the northern portion of NWF.

Hazardous Material and Hazardous Waste Management

The affected environment or present conditions at NWF with regards to hazardous materials and hazardous waste management would be the same as described in Section 3.16.1 of this SEIS, which provides a summary of hazardous materials, hazardous waste, toxic substances, and contaminated site information pertinent to Guam. No hazardous materials storage or hazardous waste accumulation areas are located in the area of NWF proposed for development of the LFTRC.

Contaminated Sites

Installation Restoration Program Sites

There are two IRP and five potentially contaminated sites located in the area of NWF proposed for development for this LFTRC alternative. Only two of these sites are currently active and are depicted in Figure 5.5.16-1. The seven IRP and AOC sites are listed in Table 5.5.16-1 and described in the 2010 Final EIS (Volume 9, Appendix G: EIS Resource Technical Appendix, Chapter 3: Hazardous Materials and Waste Resources, Table 3.6-1 Summary of Active Navy Environmental Restoration Sites on AAFB, pages G-3-28 to G-3-37 and Table 3.6-22 Summary of Applicable SWMUs and AOC Sites on AAFB, pages G-3-38 to G-3-43).

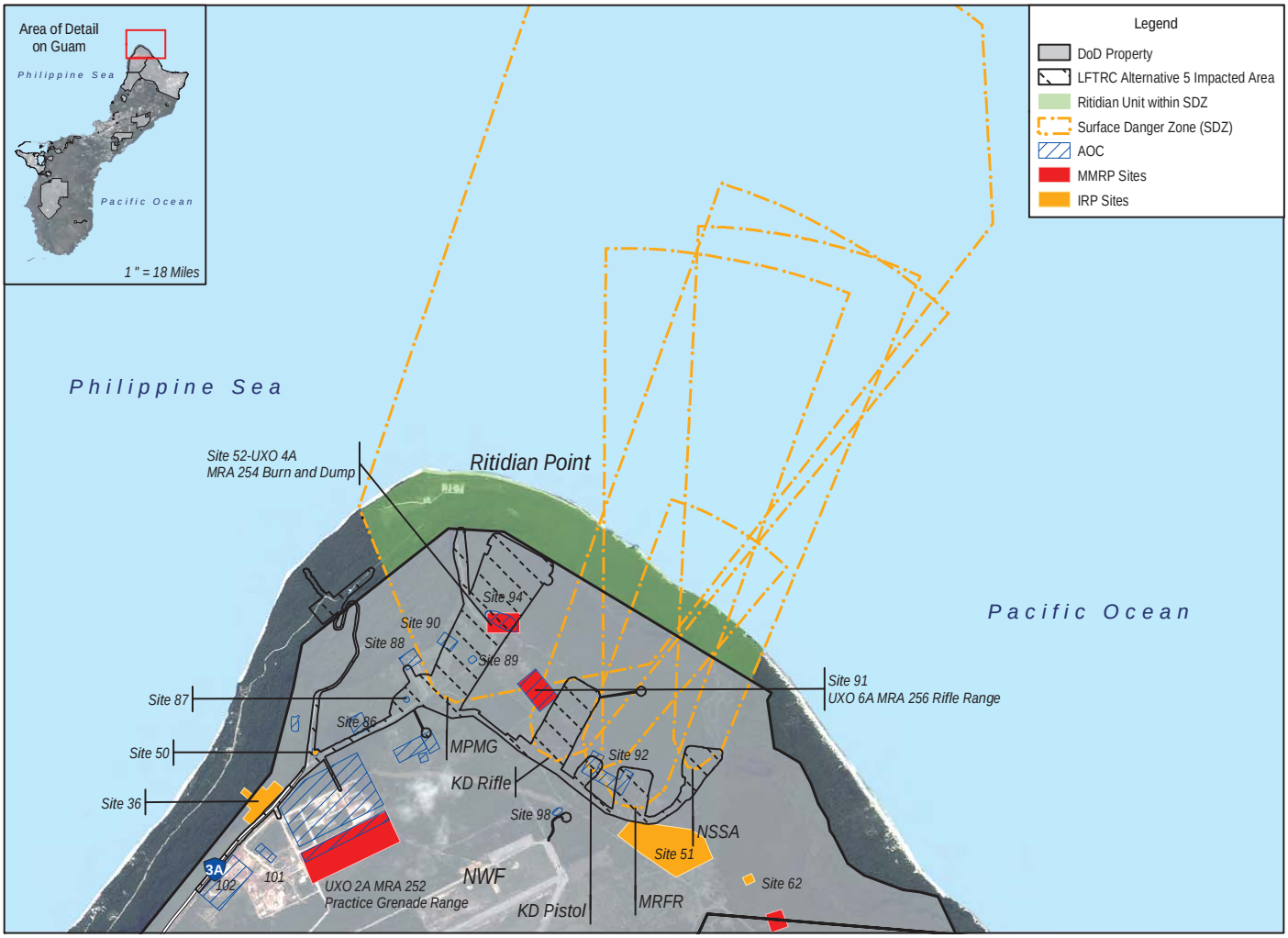


Figure 5.5.16-1
IRP Sites, MMRP Sites, and AOC in the Vicinity of NWF LFTRC Alternative 5

In addition to these sites, there is one IRP site and seven AOCs within 0.25 mile (0.4 km) of the area of NWF proposed for development for this LFTRC alternative (Figure 5.5.16-1). These sites are listed in Table 5.5.16-1 and described in the 2010 Final EIS (Volume 9, Appendix G: EIS Resource Technical Appendix, Chapter 3: Hazardous Materials and Waste Resources, Table 3.6-1 Summary of Active Navy Environmental Restoration Sites on AAFB, pages G-3-28 to G-3-37 and Table 3.6-6 Summary of Applicable SWMUs and AOC Sites on AAFB, pages G-3-38 to G-3-43).

Table 5.5.16-1. IRP and Potentially Contaminated Sites on NWF

Site Name	*Area (acre [ha])*	*Status*
Site 50 (AOC 85)-Building 8024	10 (4)	Active
AOC 86-Achae Point quarry	6 (2.4)	No Further Action
AOC 87-Radar bomb scoring site cleared area	1 (0.4)	No Further Action
AOC 89-Lighthouse Road quarry	1 (0.4)	No Further Action
AOC 90-Mt. Machanao area	1 (0.4)	No Further Action
AOC 92-Abandoned AVGAS tanks	12 (5)	No Further Action
Site 51 (AOC 93)- South runway approach zone	16 (6.5)	Active

Military Munitions Response Program

Three MMRP sites were identified in the area of NWF proposed for development for this LFTRC alternative (Table 5.5.16-2).

Table 5.5.16-2. MMRP Sites on NWF

Site Name	*Area (acre [ha])*	*Status*
UXO 2A MRA 252 Practice Grenade Range	3 (14)	Active
Site 52-UXO 4A MRA 254 Burn and Dump Site (AOC-94)	9 (3.6)	Active
UXO 6A MRA 256 Rifle Range (AOC-91)	6 (2.4)	Active

Toxic Substances Management

The proposed project area under this alternative is largely undeveloped. However, a few structures are located in the area that may be affected by the proposed development of an LFTRC. Any structure constructed prior to 1978 may contain LBP, ACM and PCBs.

According to USEPA, the parcel is located in an area classified as Zone 1 for Radon, indicating average indoor radon levels of greater than 4 pCi/L.

5.5.16.2 Environmental Consequences

Impacts to hazardous materials, hazardous waste and toxic substances under this alternative would be the same as those described under Section 5.1.16.2 of this SEIS. As described in Section 5.1.16.2, should there be a need to import off-island earthen materials, all GEPA, Department of Agriculture, and local rules and regulations would be followed. Therefore, implementation of Alternative 5 would result in less than significant direct or indirect impacts.

Construction

Contaminated Sites

There are contaminated sites undergoing characterization and/or restoration under various DoD environmental programs located within or in close proximity to the proposed construction areas under this alternative. Consideration and careful attention during project design phases must be given prior to construction to avoid overlap with these sites. If relocation of proposed construction projects that may overlap these contaminated sites is not possible, then various BMPs and construction operational protocol must be followed to protect human health and the environment. Adherence to applicable BMPs would reduce the likelihood and volume of direct accidental releases from site disturbance and enable timely implementation of cleanup measures, thereby minimizing potential direct or indirect impacts to the environment. In addition, special design techniques and methodology would be required to ensure the long-term structural integrity of proposed construction projects.

Installation Restoration Program Sites

All of the IRP sites that require no further action have been subject to health risk evaluations that have determined that these sites do not pose a public health risk as noted in the 2010 Final EIS (Volume 9, Appendix G, Section 3.6, Table 3.6-2, page G-3-39 and G-3-40). Development within or in the vicinity of these sites would be conducted in a manner protective of worker health and safety and in accordance with any land use controls that may have been placed on the sites.

Currently active sites would be subject to site specific investigations and remedial actions in accordance with Comprehensive Environmental Response Compensation and Liability Act as outlined in the facility Site Management Plan (2009) prior to construction activities. Contaminants of concern include antimony at Site 50 and aluminum and chromium and Site 52. Therefore, less than significant direct or indirect impacts would occur.

Military Munitions Response Program Sites

Active MMRP sites would be subject to a Comprehensive Site Evaluation process to fulfill the requirements of a Comprehensive Environmental Response Compensation and Liability Act Preliminary Assessment and Site Investigation prior to construction activities. UXO, MC and MEC, if present, would be removed from the MMRP sites as well as any contaminants of concern such as metals or explosives residues and disposed of in accordance with applicable federal and local regulations. Therefore, less than significant direct or indirect impacts would occur.

Operation

Hazardous Materials

Live-fire training ranges would generate a long-term increase in the release of hazardous materials from expended training materials resulting from proposed new training operations, and the impacts would be similar to those described in Section 5.1.16.2 of this SEIS. As described in Section 5.1.16.2, direct or indirect impacts would be less than significant.

Contaminated Sites

Contaminated sites (IRP and MMRP) identified under this alternative have been investigated and determined to pose no risk to human health or environmental receptors or would be investigated and remediated prior to facility construction to ensure than no health hazards would be present during site

operations. Therefore, the impacts to IRP/MMRP sites under this alternative would be less than significant.

5.5.17 Public Health and Safety

5.5.17.1 Affected Environment

Operational Safety

To protect the general public from intentional or accidental entry onto the NWF at AAFB, locked or manned gates are used where vehicles access is provided and a series of warning signs cautioning unauthorized personnel not to enter the area are posted along the perimeter of the installation. Unauthorized personnel are not allowed on the installation at any time.

The AAFB MSA is situated near NWF. Explosives handling and storage is the primary function of the AAFB MSA. Facilities within the MSA and the other areas within NWF that handle munitions have associated ESQD arcs that restrict the construction of inhabited buildings and other non-munitions related activities to minimize potential impacts on personnel and the general public from an explosive mishap.

Environmental Health Effects

Noise

Noise sources in and around NWF include surface traffic and other ground-training activities. Currently, the NWF south runway is used for fixed-wing aircraft operations and airborne operations, which include airdrop operations at a drop zone on the eastern end of the runway. The north runway is used for helicopter practice landings and airdrop operations at a drop zone on the eastern end of the runway. However, mission activities are scheduled to be moved. The North Runway would be the primary landing zone as well as the location for the drop zone, which would be moved more than 1 mile (1.6 km) southwest of its current location. Aircraft operations and ground-training activities at NWF are infrequent. Noise modeling for these operations has not been performed as there are fewer than 10 jet or 25 propeller-driven aircraft operations per day and noise contours are not anticipated to extend beyond the installation boundary. Details regarding current noise conditions at NWF are provided in Section 5.5.4.1.

Water Quality

Several water wells are situated within the NWF. Well AF-5 currently services the NWF. In addition, 11 new wells are planned for installation in this general area of AAFB. These wells each have a mandated 1,000-foot (305-m) buffer identified as a wellhead protection zone. Within this zone, future activities and development are restricted to ensure that contaminants are not introduced in these areas to protect the integrity of the island's freshwater aquifers. Guam's freshwater aquifers are susceptible to contamination from surface activities. GEPA requires treatment to ensure water quality meets safe drinking water standards. Section 5.5.2.1 provides details regarding current quality of potable water sources.

Hazardous Substances

The IRP focuses on cleaning up releases of hazardous substances that pose risks to the general public and/or the environment. The MMRP focuses on identifying and removing MEC. Nine AOC sites are situated within the area of NWF where the Alternative 5 development is proposed. These sites include AOCs 85, 86, 87, 89, 90, 91, 92, 93, and 94 (DON 2010b). Based on health risk evaluations, no further action has been recommended for AOCs 86, 87, 89, 90, and 92. A ROD has been prepared for AOCs 85 and 93 for soil excavation and removal. These sites have not yet been closed. AOCs 91 (UXO 4A) and 94 (UXO 6A) are both MMRP sites that are situated within the proposed MPMG live-fire training area.

For AOC 91, soil remedial or removal action has been recommended. For AOC 94, further investigation has been recommended to characterize the existence of UXO contamination or its potential for a release to the environment. The hazardous materials and waste section of this SEIS (see Section 5.5.16) provides additional detail about the status of AOC and MMRP sites.

Unexploded Ordnance

NWF is known to have a high probability for MEC as a result of the occupation by Japanese forces during WWII and subsequent assault by Allied/American forces to retake the island (DON 2012).

Traffic Incidents

No high crash frequency locations have been identified in the vicinity of Alternative 5.

5.5.17.2 Environmental Consequences

Potential impacts on public health and safety from implementation of Alternative 5 would be similar to those discussed under Alternative 1 (see Section 5.1.17).

Operational Safety

Construction Safety

Potential impacts from construction safety would be similar to those discussed for Alternative 1. During construction activities, a health and safety program would be implemented by the construction contractors based on industry standards for accident and pollutant release prevention. Because a health and safety program would be implemented for construction activities and the general public would be excluded from entering construction areas, potential short-term construction impacts on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to construction activities is anticipated.

Operation/Range Safety

To protect the general public from intentional or accidental entry onto live-fire training ranges, a series of warning signs cautioning unauthorized personnel not to enter the area would be posted along the perimeter of the installation, as well as at the range area. Unauthorized personnel would not be allowed on the installation or range at any time. Civilian watercraft may inadvertently enter portions of the SDZ that extend over nearshore waters. Two Range Observation Towers would be erected to provide surveillance of the nearshore SDZ. Live-fire training would cease if the SDZ is penetrated by watercraft and would resume once the watercraft clears the SDZ.

SOPs require that before conducting training activities, the general public and non-participating personnel would be cleared from the area so that the only public health and safety issue would be if a training event exceeded the safety area boundaries. Risks to public health and safety would be reduced by confirming that the training area is clear. The Range Safety Officer would ensure that hazardous areas are clear of personnel during training activities. After a live-fire event, the participating unit would ensure that weapons are safe and clear of live rounds.

The position of the SDZs overlays the existing USFWS Ritidian Unit Administration Building and Visitors Center. As part of Alternative 5 development, these facilities would be relocated outside the SDZ footprint and general public access to a portion of the Wildlife Unit area would be reduced, to eliminate this conflict.

Possible interactions between training activities within nearshore areas would be minimized by ensuring that the area is cleared. Recreational diving activities within nearshore areas take place primarily at known diving sites, and dive boats typically are well marked with diver down flags. The Marine Corps also may notify the general public about training activities through Notices to Airmen and Notices to Mariners.

Public notification of training activities, use of established training areas, compliance with appropriate range safety procedures, and relocation of non-participating facilities would reduce the potential for interaction between the general public and personnel that are training. Specific and documented procedures would be in place to ensure the general public is not endangered by training activities. Therefore, Alternative 5 would result in no direct or indirect impact on public health and safety (resulting from operations and training activities).

Electromagnetic Safety

Use of the NWF to support live-fire training activities would be conducted so that new developments and training areas are consistent with established EMR hazard zones. Exposure to electromagnetic emissions would be limited by restricting access to emitters through the use of security fencing, posting warning signs, or locking out unauthorized persons in areas, where practical. Because electromagnetic emission sources would be operated in accordance with applicable safety standards and the general public would be excluded from entering areas where emission sources are located, potential long-term impacts from electromagnetic emissions on public health and safety would not result in any greater safety risk. Therefore, no direct or indirect impact on public health and safety related to electromagnetic emissions is anticipated.

Explosive Safety

Under Alternative 5, SDZs have been defined for each of the ranges in the proposed LFTRC to identify the areas requiring control of unauthorized access to live-fire training operations. The SDZs established for Alternative 5 reflect a "worst case scenario" for weapons use to ensure the safety of on- and off-range personnel and civilians. The proposed layout of the SDZs is provided in Chapter 2.

The current munitions operations and storage area have associated ESQD arcs that restrict the construction of inhabited buildings and other non-munitions related activities to minimize potential impacts on personnel and the general public from an explosive mishap. The ESQD arcs do not overlay Alternative 5 firing positions or the associated SDZs. Because the ESQD arcs do not overlay Alternative 5 firing positions or SDZs, no conflict between the current munitions storage activities and Alternative 5 activities would occur.

Ordnance used at Alternative 5 would be handled, stored, and transported in accordance with Marine Corps explosive safety directives (MCO P8020.10A, *Marine Corps Ammunition Management and Explosives Safety Policy Manual*), and munitions handling would be carried out by trained, qualified personnel. With implementation of appropriate range safety procedures, no direct or indirect impact on public health and safety is anticipated.

Environmental Health Effects

Noise

Potential impacts on public health and safety from Alternative 5 noise would be similar to those discussed for Alternative 1. Increases in noise emissions associated with implementation of the short-term construction phase of this alternative with identified BMPs would be less than significant. Enforcement of

OSHA guidelines for hearing protection for workers would be the responsibility of the construction contractor. Noise from Alternative 5 activities (i.e., weapons firing) would be heard at the PRTC and on adjacent lands from the range. Some adjacent lands north and west of Alternative 5 include recreational and institutional uses. However, no people would be exposed to incompatible noise levels (see Section 5.5.4.2). The noise generated from Alternative 5 activities would not result in loss of hearing to individuals in these areas, as the PRTC is located beyond Noise Zone 1 and well below the USEPA guidance of level 75 dB for long-term noise exposure (USEPA 1974). Based on the modeled noise for Alternative 5 activities (see Section 5.5.4), the overall direct or indirect impacts associated with noise on public health and safety would be less than significant.

Water Quality

Potential impacts on public health and safety from water quality concerns would be similar to those discussed for Alternative 1. Groundwater withdrawal would be likely to increase. However, sustainability practices would be implemented to reduce the amount of groundwater needed (see Section 5.2.2.2). The resulting total annual groundwater withdrawal would be less than the sustainable yield, and monitoring of groundwater chemistry would identify any emerging issues to ensure no harm to the water supply. Water wells on NWF have a mandated 1,000-foot (305-m) buffer identified as a wellhead protection zone. Proposed development and operational activities would be conducted in accordance with GEPA guidance and BMPs to minimize the potential for contaminants to be introduced in these areas.

Because measures would be taken to maintain a sustainable water supply and water well locations would be protected from future development and operational activities, public health and safety impacts (direct or indirect) from long-term increased demand on potable water and potential water-related illnesses would be less than significant.

Hazardous Substances

Potential safety impacts from use of hazardous substances would be similar to those discussed for Alternative 1. Implementation of this alternative would result in an increase in the use, handling, storage, transportation, and disposition of hazardous substances. These activities would be conducted in accordance with applicable hazardous material and waste regulations, and established BMPs and SOPs to ensure that health and safety of workers and the general public is maintained. IRP and MMRP investigations and/or remediation activities, as necessary, would continue in an effort to clean up past releases of hazardous substances that pose a risk to the general public and the environment, and receive regulator concurrence that necessary actions have been completed to ensure the safety of the general public. Because hazardous substance management and IRP and MMRP investigative/cleanup activities would be conducted in accordance with applicable regulations and established BMPs and SOPs, no direct or indirect impact on public health and safety is anticipated.

With regard to exposure to airborne toxic dust related to live-fire training activities and range maintenance, lead is the primary contaminant of concern. Very small lead particles can become airborne if wind, foot traffic, or maintenance activities disturb lead-contaminated soil. Firing ranges would be designed and constructed so that participating personnel are not exposed to airborne contaminants above permissible limits. No residential population is located near the proposed Alternative 5 and emissions migrating off range would likely be much lower than on-site. Analysis of firing range emissions presented in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.2.7, Summary of Impacts, Table 5.2-5, page 5-36) indicated that operations emissions from firing range components would be well below significance criteria. Because range maintenance procedures ensure that participating personnel are not exposed to airborne contaminants above permissible limits and analysis of firing range emissions are

below significance criteria, a less than significant direct or indirect impact on public health and safety from firing range activities is anticipated.

Unexploded Ordnance

Potential impacts from UXO would be similar to those discussed for Alternative 1. Excavation for building foundations, roads, underground utilities, and other infrastructure could encounter unexploded military munitions in the form of UXO, DMM, and/or MPPEH. Exposure to MEC could result in death or injury to workers with the exception of public access provisions outlined through the 2011 PA process (see Section 4.4.10, Cultural Resources); the general public would be excluded from entering construction zones and training areas. To reduce the potential hazards related to the exposure to MEC, ESS documentation would be prepared to outline specific measures that would be implemented to ensure the safety of workers and the general public. BMPs that would be implemented would include having qualified UXO personnel perform surveys to identify and remove potential MEC items before beginning ground-disturbing activities. Additional safety precautions would include having UXO personnel supervision during earth-moving activities and providing MEC awareness training to construction personnel involved in grading and excavations before and during ground-disturbing activities. In addition, the DON provides MEC awareness training to GovGuam and other public representatives allowing access to project sites to facilitate surveys or collection of natural resources or items of cultural significance prior to conducting vegetation clearance. Because UXO would be identified and removed before beginning construction activities and construction personnel would be trained about the hazards associated with unexploded military munitions, potential direct or indirect impacts from encounters with UXO would be minimized and would be less than significant.

Traffic Incidents

Potential long-term traffic incident increases would be small (5% increase [see Section 4.1.17.2]). Because no high crash frequency intersections are located near NWF and the overall potential long-term increase in the number of traffic accidents as a result of the increase in personnel would be minimal, a less than significant impact is anticipated on the health and safety of the citizens of Guam.

5.5.18 Environmental Justice and the Protection of Children

5.5.18.1 Affected Environment

The affected environment under Alternative 5 is considered to be the entire island of Guam, as discussed in Section 4.1.18.1 of this SEIS. The proposed action under Alternative 5 would be located within the northern region of Guam, as defined in Section 4.1.18.1. The villages of Dededo and Yigo are within this region.

5.5.18.2 Environmental Consequences

Potential impacts to environmental justice populations from Alternative 5 would be related to noise, recreation, and public health and safety. There would be no impacts from land acquisition, since Alternative 5 does not require federal land acquisition. The impact analysis discussion provided in the following sections is focused primarily on operational impacts of implementing the proposed LFTRC alternative, as LFTRC construction impacts as related to environmental justice would be minimal and short-term, with no measurable effect on Guam's special-status populations.

Noise

Similar to Alternative 3, there would be no impact due to construction noise under this alternative because construction activities would be within the NWF away from any sensitive receptors. Construction areas along the access road to Ritidian Point would be approximately 0.25 mile (0.4 km) away from the nearest receptors.

There would be no direct impacts due to live-fire training noise under this alternative because there would be no populated residential areas affected and none of the noise significance criteria stated in the Marine Corps Guidance memo for land use and noise exposure would be exceeded, as described in Section 5.5.4, Noise. There would be no direct impacts because no population is affected and none of the significance criteria would be exceeded.

There would be environmental justice impacts from noise during the operational phase due to the HG Range at Andersen South. These impacts would be the same as described under Alternative 1.

Recreation

As described in Section 5.5.7, Recreational Resources, there are numerous public recreational resources in northern Guam. Recreational resources that would potentially be affected by implementation of Alternative 5 include beaches (e.g., Tarague Beach), picnic sites, campsites, and the Guam NWR.

Construction would be limited to DoD lands, would not impact recreational resources, and would be temporary in nature. Significant impacts to recreational resources during the construction phase are not anticipated and would mostly be limited to slow moving construction and earth-moving equipment traversing public roads and possibly slowing the public's access to recreational resources.

The access restrictions resulting from implementation of Alternative 5 would result in significant impacts to recreational resources and the need to relocate the USFWS Nature Center. In addition to access restrictions, there are potential indirect impacts from firing range noise, which could lessen visitor enjoyment of recreational resources in the area and affect uses by private landowners at Jinapsan Beach.

Tier 1: Are there any minority, low-income, or children populations that would be impacted?

Yes, recreational resources are generally used by all people of Guam, which includes a high proportion of racial or ethnic minorities, low-income individuals, and children.

Tier 2: Are the applicable disadvantaged groups disproportionately affected by the negative environmental consequences of the proposed action(s)?

No, minority and low-income populations and children are not disproportionately affected by the increase in demand to recreation areas, because the entire region has a minority or special status population. All people of Guam would be affected by impacts to recreational resources. Therefore, Alternative 5 would not result in disproportionately high and adverse effects on minority or low-income populations nor would there be disproportionate risks to the health and safety of children.

Public Health and Safety

The potential impacts would be the same as Alternative 1.

5.6 NO-ACTION ALTERNATIVE

The 2010 ROD deferred selection of a specific site for an LFTRC on Guam. Consequently, under the No-Action Alternative for this SEIS, no LFTRC would be developed. The existing conditions would be unchanged and there would be no impacts to any of the resource areas under the No-Action Alternative in Chapter 5.

5.7 SUMMARY OF IMPACTS AND POTENTIAL MITIGATION MEASURES FOR THE LIVE-FIRE TRAINING RANGE COMPLEX ALTERNATIVES

Table 5.7-1 summarizes the impacts and potential mitigation measures for each LFTRC alternative evaluated in this chapter. Impacts include both construction and operation impacts. As discussed in Section 5.6, under the No-Action Alternative, the LFTRC would not be constructed and there would be no impacts to any of the resource areas discussed in this SEIS associated with the LFTRC. Thus, the No-Action Alternative is not presented in Table 5.7-1.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Geological and Soil Resources				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Topography ***SI*** Major changes to surface elevation due to excavation and filling for construction of MPMG, MRF, KD ranges, and realignment of Route 15 would have a significant, direct, long-term impact to topography. Earthwork for LFTRC Alternative 1 would include 2,488,676 yd^3 (1,902,730 m^3) of cut and 2,451,937 yd^3 (1,874,640 m^3) of fill. Alternative 1 would involve a lower excavation volume than Alternatives 3 and 4, and a larger volume than Alternatives 5 and 2 (Alternative 3 would involve the greatest; Alternative 2 would involve the least). ***Potential Mitigation Measures*** **Potential mitigation is not considered feasible for this impact because smaller cut/fill volumes would not provide the necessary level surfaces for the referenced ranges and roadway.**	Topography ***LSI*** Because the elevation changes at Alternative 2 are smaller than those of the other alternatives, less excavation, filling, and contouring would occur at Alternative 2 so there would be less alteration of the surrounding landscape than at the other four alternatives. Therefore, Alternative 2 is expected to have a less than significant direct, long-term impact on topography. Earthwork would include 1,246,720 yd^3 (953,186 m^3) of cut and 1,254,698 yd^3 (959,286 m^3) of fill. Alternative 2 would involve the least volume of excavation of any of the alternatives.	Topography ***SI*** Major changes to surface elevation due to excavation and filling for construction of MPMG, MRF, and KD ranges would have a significant, direct, long-term impact to topography. Earthwork would include 4,932,976 yd^3 (3,771,530 m^3) of cut and 3,130,058 yd^3 (2,393,100 m^3) of fill. Alternative 3 would involve the largest volume of excavation of any of the alternatives. ***Potential Mitigation Measures*** **Similar to Alternative 1, i.e., potential mitigation is not considered feasible and is not proposed.**	Topography ***SI*** Major changes to surface elevation due to excavation and filling for construction of MPMG and KD ranges would have a significant, direct, long-term impact to topography. Earthwork would include 2,716,125 yd^3 (2,076,627 m^3) of cut and 2,767,463 yd^3 (2,115,878 m^3) of fill. Alternative 4 would involve the second largest volume of excavation any of the alternatives (Alternative 3 would involve the greatest; Alternative 2 would involve the least). ***Potential Mitigation Measures*** **Similar to Alternative 1, i.e., potential mitigation is not considered feasible and is not proposed.**	Topography ***SI*** Major changes to surface elevation due to excavation and filling for construction of MPMG Range would have a significant, direct, long-term impact to topography. Earthwork would include 2,047,295 yd^3 (1,565,270 m^3) of cut and 1,932,392 yd^3 (1,477,420 m^3) of fill. Alternative 5 would involve the second lowest amount of excavation of all the alternatives (Alternative 3 would involve the greatest; Alternative 2 would involve the least). ***Potential Mitigation Measures*** **Similar to Alternative 1, i.e., potential mitigation is not considered feasible and is not proposed.**
LSI Minor changes in surface elevations due to excavation and filling for the HG Range would have direct, long-term, less than significant impacts.	***LSI*** Minor changes in surface elevations due to excavation and filling for the HG Range would have direct, long- term, less than significant impacts.	***LSI*** Minor changes in surface elevations due to excavation and filling for the HG Range would have direct, long-term, less than significant impacts.	***LSI*** Minor changes in surface elevations due to excavation and filling for the HG Range would have direct, long-term, less than significant impacts.	***LSI*** Minor changes in surface elevations due to excavation and filling for the HG Range would have direct, long-term, less than significant impacts.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Soils ***LSI*** Potential increase in construction-related erosion Alternative 1 and the HG Range minimized through compliance with 22 GAR, Chapter 10 Guam Soil Erosion and Sediment Control Regulations and construction stormwater BMPs as per the Construction General Permit, DoD Program SWPPP, and project SWPPPs. There would be no stream re-routing involved with construction of Alternative 1. Less than significant direct, short-term impacts to soils at Alternative 1 and the HG Range from erosion. No indirect short-term impacts expected at Alternative 1 and the HG Range. Minimally-used, non-prime farmland soils would be disturbed at Alternative 1 and the HG Range. Construction of Alternative 1 and the HG Range would be a less than significant, direct, long-term impact to agricultural soils.	Soils ***LSI*** Direct, short-term impacts from construction-related erosion at Alternative 2 and the HG Range would be similar to Alternative 1. No indirect short-term impacts expected at the HG Range and Alternative 2. Construction of Alternative 2 would involve stream re-routing. Disturbance to unused prime farmland soils at Alternative 2 would be an adverse, but less than significant direct long-term impact. Disturbance to minimally-used, non-prime farmland soils at the HG Range would be a less than significant, direct, long-term impact to agricultural soils.	Soils ***LSI*** Direct, short-term impacts from construction-related erosion at Alternative 3 and the HG Range would be similar to Alternative 1. No indirect short-term impacts expected. Construction of Alternative 3 would involve stream re-routing. Construction of the HG Range would be a less than significant, direct, long-term impact to agricultural soils. ***NI*** No prime farmland is identified in the Alternative 3 development footprint. No direct or indirect impacts to agricultural soils.	Soils ***LSI*** Direct, short-term impacts from construction-related erosion at Alternative 4 and the HG Range would be similar to Alternative 1. No indirect short-term impacts expected. Construction of Alternative 4 would involve stream re-routing. Disturbance to unused prime farmland soils at Alternative 4 would be an adverse, but less than significant direct long-term impact to agricultural soils. Construction of the HG Range would be a less than significant, direct, long-term impact to agricultural soils.	Soils ***LSI*** Direct, short-term impacts from construction-related erosion at Alternative 5 and the HG Range would be similar to Alternative 1. No indirect short-term impacts expected. There would be no stream re-routing involved with construction of Alternative 5. Construction of the HG Range would be a less than significant, direct, long-term impact to agricultural soils. ***NI*** No prime farmland is identified in the Alternative 5 development footprint. No direct or indirect impacts to agricultural soils.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Sinkholes ***LSI*** Three features have been preliminarily identified as sinkholes/depressions that may contain sinkholes. No adverse impact at Alternative 1 and the HG Range with compliance with 22 GAR Chapter 10 § 10106F. Less than significant direct, short-term impacts to sinkholes.	Sinkholes ***LSI*** HG Range: Impacts would be similar to Alternative 1, since the location would remain the same. ***NI*** There are no sinkholes in the volcanic bedrock underlying Alternative 2. There would be no direct or indirect short or long term impacts.	Sinkholes ***LSI*** Four features have been preliminarily identified as sinkholes/depressions that may contain sinkholes. Impacts for Alternative 3 and the HG Range would be similar to Alternative 1.	Sinkholes ***LSI*** Three features have been preliminarily identified as sinkholes/depressions that may contain sinkholes. Impacts for Alternative 4 and the HG Range would be similar to Alternative 1.	Sinkholes ***LSI*** Seven features have been preliminarily identified as sinkholes/depressions that may contain sinkholes. Impacts for Alternative 5 and the HG Range would be similar to Alternative 1.
Geologic Hazards ***LSI*** One major and one minor bedrock fault cross the Alternative 1 footprint. No bedrock faults cross the HG Range footprint. Potential for earthquake-generated fault rupture/ground shaking to cause structure damage and injury would be minimized with application of UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 during design and construction. Compliance with 22 GAR Chapter 10 § 10106F would minimize potential geologic hazards associated with sinkholes. Therefore, construction of Alternative 1 and the HG Range would result in less than significant direct and indirect short-term impacts associated with geologic hazards.	Geologic Hazards ***LSI*** One major bedrock fault crosses the Alternative 2 footprint. Impacts for Alternative 2 and the HG Range would be similar to Alternative 1.	Geologic Hazards ***LSI*** One minor bedrock fault crosses the Alternative 3 footprint. Impacts for the Alternative 3 and the HG Range would be similar to Alternative 1.	Geologic Hazards ***LSI*** One minor bedrock fault crosses the Alternative 4 footprint. Impacts for Alternative 4 and the HG Range would be similar to Alternative 1.	Geologic Hazards ***LSI*** Impacts for the LFTRC and HG Range areas would be similar to Alternative 1. Potential hazard to workers if USFWS facilities are demolished would be minimized with tsunami hazard communication and evacuation procedures.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Topography ***NI*** No large scale grading and changes to elevation at Alternative 1 and the HG Range. No direct or indirect impacts.	Topography ***NI*** Impacts for Alternative 2 and the HG Range would be similar to Alternative 1, because operations at the proposed LFTRC site would not alter topography post construction.	Topography ***NI*** Impacts for the Alternative 3 and the HG Range would be similar to Alternative 1.	Topography ***NI*** Impacts for Alternative 4 and the HG Range would be similar to Alternative 1.	Topography ***NI*** Impacts for the Alternative 5 and the HG Range would be similar to Alternative 1.
Soils ***LSI*** There would be about 30 acres (12 ha) for Alternative 1 and about 1 acre (0.4 ha) for the HG Range of associated impervious surfaces. Potential for erosion associated with firing range operations at Alternative 1 and HG Range would be minimized by application of Marine Corps range management policies and procedures and preparing a Range Fire Management Plan. Potential for erosion from minimal surface disturbance for maintenance activities would be reduced by implementation of construction stormwater BMPs. With implementation of Marine Corps range management policies and procedures and stormwater BMPs (for ranges and utility maintenance), less than significant direct and indirect long-term impacts to soils from erosion would occur due to Alternative 1 and HG Range operations.	Soils ***LSI*** There would be about 29 acres (12 ha) for Alternative 2 and about 1 acre (0.4 ha) for the HG Range of associated impervious surfaces. Impacts from erosion associated with firing range operations at Alternative 2 and the HG Range would be similar to Alternative 1. Operation of the HG Range and Alternative 2 would have a less than significant direct, long-term impact to agricultural soils.	Soils ***LSI*** There would be about 20 acres (8 ha) for Alternative 3 and about 1 acre (0.4 ha) for the HG Range of associated impervious surfaces. Impacts from erosion associated with firing range operations at Alternative 3 and the HG Range would be similar to Alternative 1. Operation of the HG Range would be a less than significant, direct, long-term impact to agricultural soils. ***NI*** No prime farmland is identified in the Alternative 3 development footprint. No direct or long-term indirect impacts to agricultural soils.	Soils ***LSI*** There would be about 32 acres (13 ha) for Alternative 4 and about 1 acre (0.4 ha) for the HG Range of associated impervious surfaces. Impacts from erosion associated with firing range operations at Alternative 4 and the HG Range would be similar to Alternative 1. Operation of the HG Range and Alternative 4 would have a less than significant direct long-term impact to agricultural soils.	Soils ***LSI*** There would be about 29 acres (12 ha) for Alternative 5 and about 1 acre (0.4 ha) for the HG Range of associated impervious surfaces. Impacts from erosion associated with firing range operations at Alternative 5 and the HG Range would be similar to Alternative 1. Operation of the HG Range would have a less than significant, direct, long-term impact to agricultural soils. ***NI*** No prime farmland is identified in the Alternative 5 development footprint. No direct or long-term indirect impacts to agricultural soils.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Minimally-used, non-prime farmland soils would be disturbed at Alternative 1 and the HG Range. Operation of Alternative 1 and HG Range would have a less than significant, direct, long-term impact to agricultural soils.				
Sinkholes ***LSI*** No adverse impact at Alternative 1 and the HG Range sites with compliance with 22 GAR Chapter 10 § 10106F. Operation of Alternative 1 and the HG Range would have less than significant direct, long-term impacts to sinkholes.	Sinkholes ***LSI*** Impacts for the HG Range would be similar to Alternative 1. ***NI*** There are no sinkholes in the volcanic bedrock underlying Alternative 2, so operation would have no direct or indirect long-term impacts to sinkholes.	Sinkholes ***LSI*** The impacts for the HG Range and Alternative 3 would be similar to Alternative 1.	Sinkholes ***LSI*** The impacts for the HG Range and Alternative 4 would be similar to Alternative 1.	Sinkholes ***LSI*** The impacts for the HG Range and Alternative 5 would be similar to Alternative 1.
Geologic Hazards ***LSI*** Minimal hazards associated with slope instability and liquefaction. Minimal potential for earthquake-generated fault rupture and ground shaking to cause structure damage and injury due to use of UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 during design and construction. Less than significant direct, long-term hazards associated with sinkholes due to implementation of sinkhole BMPs. Less than significant direct and	Geologic Hazards ***LSI*** Minimal hazards associated with slope instability and liquefaction. Minimal potential for earthquake-generated fault rupture and ground shaking to cause structure damage and injury due to use of UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 during design and construction. Less than significant direct, long-term hazards associated with sinkholes due to implementation of sinkhole BMPs at the HG Range. Less than significant direct and indirect long-term impacts	Geologic Hazards ***LSI*** Minimal hazards associated with slope instability and liquefaction. Minimal potential for earthquake-generated fault rupture and ground shaking to cause structure damage and injury due to use of UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 during design and construction. Less than significant direct, long-term hazards associated with sinkholes due to implementation of sinkhole BMPs. Less than significant direct and indirect long-term impacts associated with geologic hazards.	Geologic Hazards ***LSI*** Minimal hazards associated with slope instability and liquefaction. Minimal potential for earthquake-generated fault rupture and ground shaking to cause structure damage and injury due to use of UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 during design and construction. Less than significant direct, long-term hazards associated with sinkholes due to implementation of sinkhole BMPs. Less than significant direct and indirect long-term impacts	Geologic Hazards ***LSI*** Minimal hazards associated with slope instability and liquefaction. Minimal potential for earthquake-generated fault rupture and ground shaking to cause structure damage and injury due to use of UFC 3-310-04 Seismic Design of Buildings dated June 1, 2013 during design and construction. Less than significant direct, long-term hazards associated with sinkholes due to implementation of sinkhole BMPs. Less than significant direct and indirect long-term impacts associated with geologic hazards.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
indirect long-term impacts associated with geologic hazards.	associated with geologic hazards.		associated with geologic hazards.	
Water Resources				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Surface Water ***NI*** No surface waters are located within or near the construction area. There would be no significant direct or indirect short-term impacts to surface water.	Surface Water ***LSI*** Potential short-term increase in stormwater runoff and associated pollutants during construction could have indirect effects on surface water features. Short-term direct impacts would occur to up to 5 streams due to construction activities within and adjacent to surfaces waters. However, through compliance with the Construction General Permit and implementation of SWPPPs and associated erosion control, runoff reduction, and sediment removal BMPs, these effects would be minimized.	Surface Water ***LSI*** Potential short-term increase in stormwater runoff and associated pollutants during construction could have indirect effects on surface water features. Short-term direct impacts to up to 2 streams. Impacts as well as compliance and minimization measures would be similar as Alternative 2.	Surface Water ***LSI*** Potential short-term increase in stormwater runoff and associated pollutants during construction could have indirect effects on surface water features. Short-term direct impacts to up to 7 streams. Impacts as well as compliance and minimization measures would be similar as Alternative 2.	Surface Water ***NI*** Same as Alternative 1.
Groundwater ***LSI*** Potential for stormwater to reach NGLA. Stormwater runoff and sinkhole protection measures would serve to protect groundwater quality, resulting in less than significant direct or indirect short-term impacts.	Groundwater ***LSI*** Minor potential for stormwater to reach local aquifers (not the NGLA). Stormwater runoff protection measures would serve to protect groundwater quality, resulting in less than significant short-term impacts.	Groundwater ***LSI*** Groundwater is primarily in the low-permeability volcanic rocks in the area. Impacts and avoidance measures would be similar to Alternative 2.	Groundwater ***LSI*** Similar to Alternatives 2 and 3, since the Alternative 4 project area (not including the HG Range) overlaps the Alternatives 2 and 3 project areas.	Groundwater ***LSI*** Similar to Alternative 1, there would be a potential for stormwater to reach NGLA. Stormwater runoff and sinkhole protection measures would serve to protect groundwater quality, resulting in less than significant direct or indirect short-term impacts.
Nearshore Waters ***NI*** Stormwater runoff from the project area would not enter nearshore waters.	Nearshore Waters ***NI*** Stormwater runoff from the project area would occur more than 1 mile (1.6 km) inland from the coastline and would not cause indirect impacts to nearshore waters in Talofofo Bay.	Nearshore Waters ***NI*** Same as Alternative 2.	Nearshore Waters ***NI*** Same as Alternative 2.	Nearshore Waters ***NI*** The project area would be approximately 0.04 mile (0.06 km) from nearshore waters, and would cause no impact due to compliance with the Construction General Permit and implementation of SWPPPs.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Wetlands ***NI*** No wetlands are located within or near the construction areas.	Wetlands ***SI-M*** Direct long-term impact to up to 18 acres (7 ha) of potentially jurisdictional wetland areas due to proposed cut and fill of wetlands associated with the Sarasa and Malaja rivers. As required under the Section 404 permitting process, a mitigation plan would be prepared. Alternative 2, although significant, would have less of an impact to wetlands than Alternatives 3 or 4. ***Potential Mitigation Measures*** **If LEDPA, a Section 404 permit would be obtained for unavoidable impacts to jurisdictional wetlands. Direct impacts would be mitigated by creating new wetlands, restoring or enhancing existing wetlands, or preserving existing wetlands areas on Guam to, at a minimum, replace the area filled.**	Wetlands ***SI-M*** Direct impact to up to 37 acres (15 ha) of potentially jurisdictional wetland areas would result in long-term, direct impacts at the MPMG and KD Rifle ranges and range roads. As required under the Section 404 permitting process, a mitigation plan would be prepared. Alternative 3 would have the greatest impact to wetlands, compared to all LFTRC alternatives. ***Potential Mitigation Measures*** **Same as Alternative 2.**	Wetlands ***SI-M*** Direct impact to up to 25 acres (10 ha) of potentially jurisdictional wetland areas would result in long-term, direct impacts at the MPMG and KD Rifle ranges and range roads. As required under the Section 404 permitting process, a mitigation plan would be prepared. Alternative 4, although significant, would have less of an impact to wetlands than Alternative 3. ***Potential Mitigation Measures*** **Same as Alternative 2.**	Wetlands ***NI*** No wetlands are located within or near the construction areas.
	LSI Potential increase in stormwater runoff and associated pollutants could have indirect effects on wetlands. These short-term, indirect impacts would be minimized through the Construction General Permit and implementing BMPs to reduce/prevent site- and activity-specific stormwater runoff protection requirements.	***LSI*** Similar to Alternative 2, resulting in short-term, indirect impacts.	***LSI*** Similar to Alternative 2 resulting in short-term, indirect impacts.	

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Surface Water ***NI*** No surface waters are located within or near the project area and the implementation of LID and range management BMPs would ensure that there would be no increase in off-site transport of excess runoff, sediment, or pollutants for up to the 25-year storm event.	Surface Water ***LSI*** Increase in stormwater intensity and volume and increase in training-related residual contaminants. The potential for increase in wildland fires leading to increased erosion is highest in Alternative 2, compared to the other two NAVMAG alternatives. Impacts to the water quality of Fena Valley Reservoir from projectiles would be negligible. Stormwater runoff would be minimized through LID measures and BMPs for managing stormwater runoff at firing ranges. Appropriate fire suppression and mitigation measures would be incorporated into the design and range operating procedures.	Surface Water ***LSI*** Potential impacts (including to Fena Valley Reservoir) and impact minimization measures would be similar to Alternative 2, except that the potential for wildland fires would be smaller.	Surface Water ***LSI*** Potential impacts (including to Fena Valley Reservoir) and impact minimization measures would be similar to Alternative 2, except that the potential for wildland fires would be smaller in the portion of the project area on NAVMAG land.	Surface Water ***NI*** Same as Alternative 1.
Groundwater ***LSI*** Minor increase in localized recharge rates and in pollutant loading potential to the NGLA.	Groundwater ***LSI*** Minor potential for stormwater to reach local aquifers (not the NGLA).	Groundwater ***LSI*** Similar to Alternative 2 resulting in less than significant long-term, direct impacts.	Groundwater ***LSI*** Similar to Alternative 2 resulting in less than significant long-term, direct impacts.	Groundwater ***LSI*** Similar to Alternative 1, resulting in less than significant long-term, direct or indirect impacts.
Nearshore Waters ***NI*** Stormwater runoff from the project area would not enter nearshore waters. Potential impacts to nearshore water quality from SDZ would be negligible.	Nearshore Waters ***NI*** Stormwater runoff from the project area would not cause indirect impacts to nearshore waters in Talofofo Bay.	Nearshore Waters ***NI*** Similar to Alternative 2.	Nearshore Waters ***NI*** Similar to Alternative 2.	Nearshore Waters ***NI*** Similar to Alternative 2.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Wetlands ***NI*** No wetlands are located within or near the project area.	Wetlands ***LSI*** Potential minor increase in stormwater runoff and associated pollutants could have long-term, direct or indirect effects on wetlands. Stormwater runoff protection methods (i.e., LID, BMPs, and pollution prevention plans) would reduce potential impacts.	Wetlands ***LSI*** Similar to Alternative 2, resulting in less than significant long-term, direct or indirect impacts.	Wetlands ***LSI*** Similar to Alternative 2 resulting in less than significant long-term, direct or indirect impacts.	Wetlands ***NI*** No wetlands are located within or near the project area.
Air Quality				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
LSI Construction phase increase in emissions would be below the impact significance threshold of 250 tpy. The annual on-site and off-site PM emission levels would be much less than the worst-case alternative (Alternative A), for which a hot-spot impact modeling was conducted. PM impacts from Alternative 1 would be much less than Alternative A and would be result in less than significant, direct, short-term PM impacts during construction.	***LSI*** Similar to Alternative 1, with the exception of the proposed site location. The predicted construction activity annual emissions would be the same as Alternative 1, and the hot-spot impacts during construction would be similar to Alternative 1, resulting in less than significant short- and long-term hot spot air quality impacts.	***LSI*** Similar to Alternative 1, with the exception of the proposed site location. The predicted construction activity annual emissions would be the same as Alternative 1, and the hot-spot impacts during construction would be similar to Alternative 1, resulting in less than significant short- and long-term hot spot air quality impacts.	***LSI*** Similar to Alternative 1, with the exception of the proposed site location. The predicted construction activity annual emissions would be the same as Alternative 1, and the hot-spot impacts during construction would be similar to Alternative 1, resulting in less than significant short- and long-term hot spot air quality impacts.	***LSI*** Similar to Alternative 1, with the exception of the proposed site location. The predicted construction activity annual emissions would be the same as Alternative 1, and the hot-spot impacts during construction would be similar to Alternative 1, resulting in less than significant short- and long-term hot spot air quality impacts.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
LSI The on-road vehicle emissions under Alternative 1 would be substantially less than either of the modeled worst-case alternatives (Alternatives A and D). On-road hot-spot impacts during operation of Alternative 1 would result in less than significant, direct, long-term hot-spot air quality impacts.	***LSI*** The hot-spot impacts during operation would be similar to Alternative 1, resulting in less than significant short- and long-term hot spot air quality impacts.	***LSI*** The hot-spot impacts during operation would be similar to Alternative 1, resulting in less than significant short- and long-term hot spot air quality impacts.	***LSI*** The hot-spot impacts during operation would be similar to Alternative 1, resulting in less than significant short- and long-term hot spot air quality impacts.	***LSI*** The hot-spot impacts during operation would be similar to Alternative 1, resulting in less than significant short- and long-term hot spot air quality impacts.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Noise				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
LSI Graders and scrapers would be approximately 67 dB at the nearest receptor. Construction would be short-term and noise would not exceed construction noise level standards. The direct, short-term noise impacts would be less than significant.	***NI*** Construction activities would be in an unpopulated area of Guam, and construction areas would be at least 1 mile (1.6 km) away from the nearest receptors.	***NI*** Construction activities would be in an unpopulated area of Guam, and construction areas would be approximately 0.25 mile (0.4 km) away from the nearest receptors.	***NI*** Construction activities would be in an unpopulated area of Guam, and construction areas would be approximately 0.25 mile (0.4 km) away from the nearest receptors.	***NI*** Construction activities would be within the NWF at AAFB, and away from any sensitive receptors.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
SI-M Noise levels would exceed land use guidance and create a direct, long-term, significant impact from the sound exposure to nearby residences. An estimated 88 people (22 homes) would be affected in Noise Zone 2 (65-74 dB) and no people would be affected in Zone 3 (greater than 75 dB). Alternative 1 is the only alternative that would result in potentially significant impacts. ***Potential Mitigation Measures*** **Using sound berms and foliage can reduce the levels to below significance. If this alternative is chosen for implementation, a detailed noise reduction plan would be developed to reduce impacts to below significance levels.**	***NI*** Noise levels would not create a significant sound exposure because no residential areas are within Noise Zones 1, 2, or 3. No homes, residents, or other sensitive receptors would be affected. There would be no impacts from the HG Range, for the same reason as Alternative 1.	***NI*** Noise levels would not create a significant sound exposure because no residential areas are within Noise Zones 2 or 3. Approximately 70-80 homes along Route 12 would experience noise levels between 55-60 dB, and 100 homes in Agat near the Pagachao Guam House and Urban Renewal Authority Housing Area would experience noise levels between 55-68 dB; however, noise exposure at this level is considered compatible for residential use, and the actual noise may be reduced due to existing topography and vegetation. There would be no impacts from the HG Range, for the same reason as Alternative 1.	***NI*** Similar to Alternatives 2 and 3 combined. No houses lie within the Zone 2 or 3 noise contours, and the same number of homes fall within the 55-68 dB noise range as in Alternative 3. There would be no impacts from the HG Range, for the same reason as Alternative 1.	***NI*** Similar to Alternative 2, no homes, residents, or sensitive receptors would be within Noise Zones 2 or 3, and there are only uninhabited homes near Jinapsan Beach, under Noise Zone 1. There would be no impacts from the HG Range, for the same reason as Alternative 1.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
NI No residents would be affected by the noise from the HG Range, because all of the HG Range noise contours remain within Andersen South.				
Airspace				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
NI No changes to airspace would occur as a result of construction activities, and construction activities would not be expected to conflict or interfere with the use or management of existing airspace; therefore, there would be no impacts to airspace.	***NI*** Same as Alternative 1.	***NI*** Same as Alternative 1.	***NI*** Same as Alternative 1.	***NI*** Same as Alternative 1.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Civilian Air Traffic ***SI-M*** Operational activities have the potential for significant impacts to civilian aviation; however, if this alternative is selected potential impacts and mitigation would be further studied through the DON/FAA/Air Force consultation process. Studies identified potential issues to aviation within the following: Guam International airspace and instrument approach procedures, Standard Instrument Departures and Standard Terminal Arrivals, IFR/VFR traffic flows and terminal operations, known but uncharted high volume routes, existing SUA/Terminal Radar Service Area, and VFR	Civilian Air Traffic ***SI-M*** Operational activities have the potential for significant impacts to civilian aviation. Studies identified potential issues to aviation within the following: Guam International airspace and instrument approach procedures, Standard Instrument Departures and Standard Terminal Arrivals, IFR/VFR traffic flows and terminal operations. However, if this alternative is selected, potential impacts and mitigation would be further studied through the DON/FAA/Air Force consultation process. Military Air Traffic No impact.	Civilian Air Traffic ***SI-M*** Operational activities have the potential for significant impacts to civilian aviation. Studies identified potential issues to aviation within the following: Guam International airspace and instrument approach procedures, Standard Instrument Departures and Standard Terminal Arrivals, IFR/VFR traffic flows and terminal operations. However, if this alternative is selected, potential impacts and mitigation would be further studied through the DON/FAA/Air Force consultation process. Military Air Traffic No impact.	Civilian Air Traffic ***SI-M*** Operational activities have the potential for significant impacts to civilian aviation. Studies identified potential issues to aviation within the following: Guam International airspace and instrument approach procedures, Standard Instrument Departures and Standard Terminal Arrivals, IFR/VFR traffic flows and terminal operations. However, if this alternative is selected, potential impacts and mitigation would be further studied through the DON/FAA/Air Force consultation process. Military Air Traffic No impact.	Civilian Air Traffic ***LSI*** Alternative 5 is more removed from Guam International airspace than Alternatives 1-4 and based on FAA's review and the OPNAV assessment; this alternative would have less than significant impacts to civilian aviation and the national airspace system. Military Air Traffic Alternative 5 would have potentially significant impacts to military air operations in and around Andersen AFB that require deconfliction. Summary Operational impacts under Alternative 5 would be the least of all alternatives but some mitigation would still be required.

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Reporting Points. Military Air Traffic No impact. Summary Operational impacts under Alternative 1 would be the same as Alternatives 2, 3, and 4; and greater than Alternative 5. ***Potential Mitigation Measures*** **The general types of mitigation measures that could be employed may include adjusting airspace through FAA coordination. However, no specific mitigation measures are proposed at this time.**	Summary Operational impacts under Alternative 2 would be the same as Alternatives 1, 3, and 4; and greater than Alternative 5. ***Potential Mitigation Measures*** **Same as Alternative 1.**	Summary Operational impacts under Alternative 3 would be the same as Alternatives 1, 2, and 4; and greater than Alternative 5. ***Potential Mitigation Measures*** **Same as Alternative 1.**	Summary Operational impacts under Alternative 4 would be the same as Alternatives 1, 2, and 3; and greater than Alternative 5. ***Potential Mitigation Measures*** **Same as Alternative 1.**	***Potential Mitigation Measures*** **Same as Alternative 1.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Land and Submerged Land Use				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
NI There would be changes to land use initiated during construction; however, all changes in land use are considered long-term operational impacts. Therefore, there is no construction-phase analysis for this resource. See operational impacts.	***NI*** Same as Alternative 1.	***NI*** Same as Alternative 1.	***NI*** Same as Alternative 1.	***NI*** Same as Alternative 1.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Loss of Valued Use ***SI*** Long-term direct impact from loss of a unique community-valued land use, the Guam International Raceway. An existing quarry within the proposed LFTRC would be precluded from continuing operations resulting in a long-term impact to an existing land use. Alternative 1 would have the same level of impacts due to loss of valued lands as Alternatives 2, 4, and 5. ***Potential Mitigation Measures*** **The CLTC license that allows the raceway to operate at the present location expires in 2018. It is unknown if the license would be renewed irrespective of the proposed action, no potential mitigation measure has been identified.**	Loss of Valued Use ***SI*** Direct and long-term impact from restricted access to a portion of the Bolanos Conservation Area. Alternative 2 would have the same level of impacts due to loss of valued lands as Alternatives 1 and 4. ***Potential Mitigation Measures*** **DoD would work with GovGuam to develop a plan to balance the loss of conservation land use and access with the operational needs and public safety concerns.**	Loss of Valued Use ***NI*** No loss of a land use valued by the community. ***LSI*** Indirect, long-term, less than significant impact to agricultural lands, because there are no prime farmlands within the acquisition area, and less than 1% of the total important farmlands on Guam are within the acquisition area. Additionally, farmlands identified within the area are not currently in agricultural use.	Loss of Valued Use ***SI*** Similar to Alternative 2, there would be a direct and long-term impact from restricted access to a portion of the Bolanos Conservation Area. Alternative 4 would have the same level of impacts due to loss of valued lands as Alternatives 1 and 2. ***Potential Mitigation Measures*** **Same as Alternative 2.**	Loss of Valued Use ***NI*** The land use within the Ritidian Unit of the NWR encumbered by SDZs would remain Conservation.

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
LSI Direct, long-term, less than significant impact due to loss of subsistence farming acreage in an area that is not designated for agriculture.	***LSI*** Indirect, long-term, less than significant impact due to loss of prime and important farmlands identified within the area, but not currently in agricultural use.		***LSI*** Indirect, long-term, less than significant impact due to loss of prime and important farmlands identified within the area, but not currently in agricultural use.	***NI*** No impact to agricultural lands.
Public Access ***SI*** Long-term impact from new public access restrictions on GovGuam submerged lands. DoD would provide access to submerged lands to the extent possible. ***Potential Mitigation Measures*** **No mitigation measures have been identified that would reduce the significance of this impact to a less than significant level.**	Public Access ***SI-M*** Long-term loss of access to the portion of the Bolanos Conservation Area within the acquisition area. ***Potential Mitigation Measures*** **DoD would work with GovGuam to develop a plan to balance the loss of conservation land use and access with the operational needs and public safety concerns.**	Public Access ***NI*** No long-term impact related to access to Mount Lamlam or Mount Jumullong.	Public Access ***SI-M*** Similar to Alternative 2, there would be a long-term loss of access to the portion of the Bolanos Conservation Area within the acquisition area. ***Potential Mitigation Measures*** **Same as Alternative 2.**	Public Access ***SI*** Although the land and submerged land use within the Ritidian Unit of the NWR would remain as Conservation land use, there would be access restrictions to the land and submerged lands within the SDZs. Such restrictions would be limited to the minimum SDZ area and period of use required for the LFTRC. Access to non-NWR submerged lands under the custody and control of the DON would be similarly restricted. The DON would pursue an agreement with the USFWS in accordance with the provisions of Section 2822 of the FY 2015 NDAA to ensure that access restrictions to the Ritidian Unit are consistent with the purposes for which the Unit was established. New beach access is proposed near the relocation of the USFWS facilities to partially offset the impact of proposed restrictions on beach access within the SDZ. ***Potential Mitigation Measures*** **No mitigation measures have been identified.**

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
NI No impact on access to the Pågat Trail and related cultural sites.	***NI*** No additional public access restrictions on public access to Mount Lamlam or Mount Jumullong.		***NI*** No additional public access restrictions on public access to Mount Lamlam or Mount Jumullong.	***NI*** No impact on private property access. Route 3A conditions would be improved resulting in a beneficial impact to public access.
Compatibility with Current and Future Use ***SI*** There would be short- and long-term direct and indirect impacts from the LFTRC land use being incompatible with existing and future residential land uses within the noise Zone 2 and 3 contours. There would be a direct, short- and long-term significant impact associated with new restrictions on public access to the coastal and submerged lands encumbered by the SDZs generated by LFTRC operations. The significance of land use impacts resulting from implementation of Alternative 1 would be similar to that of Alternatives 2, 4 and 5; Alternative 3 is the only LFTRC alternative with no significant impact land use impact. ***Potential Mitigation Measures*** **Non-DoD action, including GovGuam updates to future community land use plans to address proposed DoD land uses.**	Compatibility with Current and Future Use ***LSI*** Long-term compatibility issues within NAVMAG regarding existing and planned land uses would be resolved through the implementation of installation master planning guidelines. ***LSI/BI*** The proposed access road increases public access to remote areas, so could be perceived as beneficial or adverse direct and long-term impact on adjacent land uses. ***NI*** The HG Range noise Zone 2 and 3 contours would not extend off-base, so would not impact existing or proposed residential land uses. LFTRC noise levels would be compatible with surrounding designated Agriculture land use.	Compatibility with Current and Future Use ***LSI*** Indirect, long-term impact from loss of designated important farmland. Land is not currently in agricultural use. ***LSI*** Long-term compatibility issues within NAVMAG regarding existing and planned land uses would be resolved in SEIS master planning processes. ***NI*** The HG Range noise Zone 2 and 3 contours would not extend off-base. LFTRC Zone 3 contours would not extend off-base. Zone 2 noise contours would extend off-base and would be compatible with surrounding designated Agriculture land use. No new utility or access road easements would be acquired.	Compatibility with Current and Future Use ***LSI to NI*** Similar to Alternative 3, with regard to agricultural lands, long-term compatibility issues, and the HG Range noise contours. ***LSI/BI*** The proposed access road increases public access to remote areas could be perceived as beneficial or adverse direct and long-term impact on adjacent land uses.	Compatibility with Current and Future Use ***NI*** The LFTRC noise Zone 2 would extend slightly into private properties east of the LFTRC but there would be no impact to land use. The private land southwest of the LFTRC would not be affected by Zone 2 noise contours. The HG Range noise Zone 2 and 3 contours would not extend off-base. No new utility or access road easements would be acquired. No impact from relocation of USFWS facilities.

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	*NAVMAG East/West (Alternative 2)*	*NAVMAG North/South (Alternative 3)*	*NAVMAG L-Shaped (Alternative 4)*	*NWF (Alternative 5)*
DoD coordination with GovGuam on military noise and hazard area information derived from Joint Land Use Studies or Range/AICUZ plans or other studies to inform future GovGuam zoning or land use decisions and minimize the potential for incompatible public or private development near military installations. **A detailed noise reduction plan would be prepared that would address impacts to exiting land uses.** ***LSI*** Any compatibility issues from the HG Range, regarding existing and planned land uses, would be resolved through application of installation master planning guidelines and land use impacts to Andersen South would be indirect, short-term, and less than significant. Impacts to farming would be direct and long-term but less than significant, because the planned acquisition area does not include agricultural land uses. ***NI*** The HG Range noise Zone 2 and 3 contours would not extend off-base, so would not impact existing or proposed residential areas.				

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
No new utility or access road easements would be acquired. There would be no land use impact on the Pacific International quarry land use.				
Recreational Resources				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
SI Direct long-term impact from permanent closure of the Guam International Raceway. Alternative 1 would have the most substantial impacts to recreational resources, compared to the other LFTRC alternatives. ***Potential Mitigation Measures*** **The CLTC license that allows the raceway to operate at the present location expires in 2018. Since it is unknown if the license would be renewed irrespective of the proposed action, no mitigation measure has been identified.** ***LSI*** Short-term direct impact from slowed access to recreational resources with use of public roads by construction vehicles.	***LSI*** Short-term, direct impacts from slowed access to recreational resources due to use of public roads by construction vehicles.	***LSI*** Similar to Alternative 2.	***LSI*** Similar to Alternative 2.	***LSI*** Construction-related vehicles travelling along Route 3A would potentially cause a less than significant adverse impact due to traffic congestion and delays to persons attempting to gain access to the Ritidian Unit. ***NI*** The Guam NWR Nature Center would be replaced at a location outside the SDZs prior to the construction of the LFTRC. The existing center would be utilized until the new center becomes operational. This would ensure uninterrupted visitor use of the center during the construction period, and yield no direct or indirect adverse impacts to recreational resources.

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
SI Direct and long-term impact from the loss of a unique community-valued recreational resource, the Guam International Raceway. ***Potential Mitigation Measures*** ***No mitigation measures have been identified.*** ***SI*** Direct and long-term impact from SDZs extending over the Pågat Point cultural site, impeding the public's access to this archaeological area during Marine Corps training. ***Potential Mitigation Measures*** ***No mitigation measures have been identified.***	***LSI*** There are no identified recreational resources in those areas that would be directly or indirectly affected by land acquisition.	***LSI*** There are no identified recreational resources in those areas that would be directly or indirectly affected by land acquisition.	***LSI*** Recreational resources directly affected by the SDZs include Mount Alifan Unit, Japanese Lookout, Almagosa Springs, and Dobo Springs within the NAVMAG property. However, there are fewer recreational resources within the area to be acquired, leading to a direct and long-term but less than significant impact. ***LSI*** Potential indirect, long-term, less than significant impacts from firing range noise on recreational resources in the area.	***SI*** Direct impacts to public access to recreational resources within the SDZ when ranges are in use. Access within the range SDZ would be restricted during range operational periods. Impacts of loss of access to the portion of the Ritidian Unit trails, caves and other cultural resources within the range SDZ would be significant. ***Potential Mitigation Measures*** ***No mitigation measures have been identified.*** ***LSI*** Long-term direct impacts from restricted access to popular dive spots and fishing zones for the public when ranges are being used. There would be limitations on access to hiking and cave exploring as well. Access to these areas would be restricted during operation of the LFTRC. However, the DON would pursue an agreement with USFWS in accordance with the provisions of Section 2822 of the FY 2015 NDAA to ensure that access restrictions to the Ritidian Unit of the Guam NWR are consistent with the purposes for which the Unit was established. Access to the Ritidian Unit during those periods when the ranges are not in use is a matter under the management authority of the USFWS. Recreational boat users would have to avoid the SDZ when the range is

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
				active or travel around the SDZ when they have to navigate through the area to reach their destination. Boaters and fishermen would be able to contact range control via radio or phone to get real time updates of active ranges, which would minimize conflicts.
NI Pågat Village, Cave, and Trail would not be impacted.				
Terrestrial Biological Resources				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Vegetation ***SI-M*** Conversion of 255 acres (103 ha) of limestone forest to developed area, which is the greatest of all alternatives. ***Potential Mitigation Measures*** **Forest enhancement on a minimum of 255 acres (103 ha) of limestone forest.**	Vegetation ***LSI*** Conversion of 19 acres (8 ha) of limestone forest and 39 acres (16 ha) of ravine forest to developed area.	Vegetation ***SI-M*** Conversion of 169 acres (68 ha) of limestone forest and 58 acres (23 ha) of ravine forest to developed area. ***Potential Mitigation Measures*** **Forest enhancement on a minimum of 227 acres (92 ha) of limestone forest.**	Vegetation ***SI-M*** Conversion of 131 acres (53 ha) of limestone forest and 62 acres (25 ha) of ravine forest to developed area. ***Potential Mitigation Measures*** **Forest enhancement on a minimum of 193 acres (78 ha) of limestone forest.**	Vegetation ***SI-M*** Conversion of 219 acres (89 ha) of limestone forest to developed area. ***Potential Mitigation Measures*** **Forest enhancement on a minimum of 219 acres (89 ha) of limestone forest.**
Terrestrial Conservation Areas ***NI*** None present	Terrestrial Conservation Areas ***NI*** Overlay Refuge, Bolanos Conservation Area - no ground-disturbing activities; only SDZs overlap Overlay Refuge lands and Bolanos Conservation Area. Implementation of BMPs would avoid and minimize impacts.	Terrestrial Conservation Areas ***SI-M*** Conversion of 275 acres (111 ha) of Overlay Refuge lands to developed area. ***Potential Mitigation Measures*** • **Submit a proposal to designate an ERA on NAVMAG.** • **Submit a proposal for the expansion of Orote Peninsula ERA.**	Terrestrial Conservation Areas ***SI-M*** Conversion of 219 acres (88 ha) of Overlay Refuge lands to developed area. ***Potential Mitigation Measures*** • **Submit a proposal to designate an ERA on NAVMAG.** • **Submit a proposal for the expansion of Orote Peninsula ERA.**	Terrestrial Conservation Areas ***SI-M*** Conversion of 298 acres (121 ha) of Overlay Refuge lands to developed area. ***Potential Mitigation Measures*** • **Submit a proposal to designate an ERA on NAVMAG.** • **Submit a proposal for the expansion of Orote Peninsula ERA.** ***LSI*** Relocation of ESA-required mitigation measure from previous AAFB action (ungulate fence).

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Native Wildlife ***LSI*** Direct impacts to 302 acres (122 ha) of potential wildlife habitat. Wildlife currently present is widespread on Guam. With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during construction activities is considered unlikely.	Native Wildlife ***LSI*** Direct impacts to 335 acres (136 ha) of potential wildlife habitat. Wildlife currently present is widespread on Guam. With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during construction activities is considered unlikely.	Native Wildlife ***LSI*** Direct impacts to 340 acres (138 ha) of potential wildlife habitat. Wildlife currently present is widespread on Guam. With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during construction activities is considered unlikely.	Native Wildlife ***LSI*** Direct impacts to 391 acres (158 ha) of potential wildlife habitat. Wildlife currently present is widespread on Guam. With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during construction activities is considered unlikely.	Native Wildlife ***LSI*** Direct impacts to 272 acres (110 ha) of potential wildlife habitat. Wildlife currently present is widespread on Guam. With implementation of BMPs, potential introduction of new or spread of existing non-native species on Guam during construction activities is considered unlikely.
Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Guam rail - impacts to 283 acres (115 ha) of rail recovery habitat. ***Potential Mitigation Measures*** • **Forest enhancement on a minimum of 255 acres (103 ha) of limestone forest.** • **Brown treesnake research and suppression.**	Special-Status Species – Federal ESA-Listed and Proposed Species ***LSI*** Mariana fruit bat - impacts to 43 acres (17 ha) of fruit bat recovery habitat; implementation of BMPs would avoid and minimize impacts. Mariana crow - impacts to 43 acres (17 ha) of crow recovery habitat; implementation of BMPs would avoid and minimize impacts. Guam rail - impacts to 49 acres (20 ha) of rail recovery habitat; implementation of BMPs would avoid and minimize impacts. Guam Micronesian kingfisher - impacts to 43 acres (17 ha) of kingfisher recovery habitat; implementation of BMPs would avoid and minimize impacts. Mariana swiftlet - noise levels within the immediate vicinity of proposed construction activities would be localized and temporary; construction activities would not impact swiftlet	Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat - impacts to 223 acres (90 ha) of fruit bat recovery habitat. Mariana crow - impacts to 230 acres (93 ha) of crow recovery habitat. Guam Micronesian kingfisher - impacts to 223 acres (90 ha) of kingfisher recovery habitat. ***Potential Mitigation Measures*** • **Forest enhancement on a minimum of 227 acres (92 ha) of limestone forest.** • **Brown treesnake research and suppression.** Mariana common moorhen - loss of two wetlands used by moorhens. ***Potential Mitigation Measures*** • **Moorhen Habitat Wetland Restoration. The DON may implement wetland**	Special-Status Species – Federal ESA-Listed and Proposed Species ***SI-M*** Mariana fruit bat - impacts to 161 acres (65 ha) of fruit bat recovery habitat. Mariana crow - impacts to 166 acres (67 ha) of crow recovery habitat. Guam Micronesian kingfisher - impacts to 161 acres (65 ha) of kingfisher recovery habitat. ***Potential Mitigation Measures*** • **Forest enhancement on a minimum of 193 acres (78 ha) of limestone forest.** • **Brown treesnake research and suppression.**	Special-Status Species – Federal ESA-Listed and Proposed Species and Critical Habitat ***SI-M*** Mariana fruit bat - impacts to 215 acres (87 ha) of fruit bat recovery habitat. Mariana crow - impacts to 215 acres (87 ha) of crow recovery habitat. Guam Micronesian kingfisher - impacts to 215 acres (87 ha) of kingfisher recovery habitat. ***Potential Mitigation Measures*** • **Forest enhancement on a minimum of 219 acres (89 ha) of limestone forest.** • **Brown treesnake research and suppression.**

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
	nesting/roosting caves approximately 2 miles (3 km) north. *Serianthes* tree - impacts to 18 acres (7 ha) of *Serianthes* recovery habitat; implementation of BMPs would avoid and minimize impacts. ***NI*** Mariana common moorhen - species is not present as there is no suitable open water habitat.	**restoration in accordance with the recommendations provided in the 2014 Wetland Restoration Feasibility Study.**		
LSI Mariana fruit bat - impacts to 81 acres (33 ha) of fruit bat recovery habitat; implementation of BMPs would avoid and minimize impacts. Mariana crow - impacts to 81 acres (33 ha) of crow recovery habitat; implementation of BMPs would avoid and minimize impacts. Guam Micronesian kingfisher - impacts to 81 acres (33 ha) of kingfisher recovery habitat; implementation of BMPs would avoid and minimize impacts. Mariana eight-spot butterfly - implementation of BMPs would avoid and minimize impacts. *Serianthes* tree - impacts to 67 acres (27 ha) of *Serianthes* recovery habitat; implementation of BMPs would avoid and minimize impacts.		***LSI*** Guam rail - impacts to 24 acres (10 ha) of rail recovery habitat; implementation of BMPs would avoid and minimize impacts. Mariana swiftlet - noise levels within the immediate vicinity of proposed construction activities would be localized and temporary; construction activities would not impact swiftlet nesting/roosting caves approximately 1 mile (1.6 km) east. Mariana eight-spot butterfly - implementation of BMPs would avoid and minimize impacts to butterflies and host plants. *Serianthes* tree - impacts to 40 acres (16 ha) of *Serianthes* recovery habitat; implementation of BMPs would avoid and minimize impacts.	***LSI*** Guam rail - impacts to 50 acres (20 ha) of rail recovery habitat. Mariana swiftlet - noise levels within the immediate vicinity of proposed construction activities would be localized and temporary; construction activities would not impact swiftlet nesting/roosting caves approximately 1 mile (1.6 km) east and 2 miles (3 km) north. Mariana common moorhen - loss of one temporary wetland used by moorhens. Mariana eight-spot butterfly - implementation of BMPs would avoid and minimize impacts to butterflies and host plants. *Serianthes* tree - impacts to 19 acres (8 ha) of *Serianthes* recovery habitat; implementation of BMPs would avoid and minimize impacts.	***LSI*** Mariana fruit bat, Mariana crow, Guam Micronesian kingfisher critical habitat - impacts to 11 acres (5 ha) of critical habitat. The remaining area of critical habitat would remain functional to serve the intended conservation role for the bat, crow and kingfisher. Guam rail- impacts to 82 acres (33 ha) of rail recovery habitat. Mariana eight-spot butterfly - implementation of BMPs would avoid and minimize impacts. *Serianthes* tree- impacts to 177 acres (71 ha) of *Serianthes* recovery habitat; implementation of BMPs, including 100-foot (30-m) buffer around one remaining mature tree at NWF, would avoid and minimize impacts.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Special-Status Species -Guam-Listed and SOGCN ***SI-M*** Impacts and mitigations associated with Guam-listed species that are also federally listed would be the same as described above for those species. No additional Guam-listed species are known to occur in the project area for this Alternative.	Special-Status Species -Guam-Listed and SOGCN ***LSI*** Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. No additional Guam-listed species are known to occur in the project area for this Alternative.	Special-Status Species -Guam-Listed and SOGCN ***SI-M*** Impacts and mitigations associated with Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***SI-M*** Pacific slender-toed gecko - impacts to 169 acres (68 ha) suitable habitat. ***Potential Mitigation Measures*** • **Forest enhancement on a minimum of 227 acres (92 ha) of limestone forest.** • **Brown treesnake research and suppression.** ***LSI*** *Merrilliodendron megacarpum* - implementation of BMPs would avoid and minimize impacts**.**	Special-Status Species -Guam-Listed and SOGCN ***SI-M*** Impacts and mitigations associated with Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***SI-M*** Pacific slender-toed gecko - impacts to 131 acres (53 ha) suitable habitat. ***Potential Mitigation Measures*** • **Forest enhancement on a minimum of 131 acres (53 ha) of limestone forest.** • **Brown treesnake research and suppression.** ***LSI*** *Merrilliodendron megacarpum* - implementation of BMPs would avoid and minimize impacts**.**	Special-Status Species -Guam-Listed and SOGCN ***SI-M*** Impacts and mitigations associated with Guam-listed species that are also federally listed would be the same as described above for those species. No additional Guam-listed species are known to occur in the project area for this Alternative.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Vegetation ***LSI*** With implementation of BMPs, range fires and potential introduction of new or spread of existing non-native species on Guam during LFTRC operations is considered unlikely.	Vegetation ***LSI*** Same as Alternative 1.	Vegetation ***LSI*** Same as Alternative 1.	Vegetation ***LSI*** Same as Alternative 1.	Vegetation ***LSI*** Same as Alternative 1.
Terrestrial Conservation Areas ***NI*** None present	Terrestrial Conservation Areas ***LSI*** Overlay Refuge, Bolanos Conservation Area -noise levels within the conservations areas from LFTRC operations would be at or below ambient noise levels; LSI to management or conservation value of conservation areas.	Terrestrial Conservation Areas ***LSI*** Overlay Refuge - no physical disturbance of Overlay Refuge lands; temporary live-fire noise impacts to 2,993 acres (1,211 ha) of Overlay Refuge lands; implementation of BMPs would avoid and minimize impacts.	Terrestrial Conservation Areas ***LSI*** Overlay Refuge - no physical disturbance of Overlay Refuge lands; temporary live-fire noise impacts to 1,525 acres (617 ha) of Overlay Refuge lands; implementation of BMPs would avoid and minimize impacts.	Terrestrial Conservation Areas ***LSI*** Overlay Refuge - no physical disturbance of Overlay Refuge lands; temporary live-fire noise impacts to 1,691 acres (684 ha) of Overlay Refuge lands; implementation of BMPs would avoid and minimize impacts.
Native Wildlife ***LSI*** With implementation of BMPs, potential impacts to wildlife from LFTRC operations would be reduced to less than significant.	Native Wildlife ***LSI*** Same as Alternative 1.	Native Wildlife ***LSI*** Same as Alternative 1.	Native Wildlife ***LSI*** Same as Alternative 1.	Native Wildlife ***LSI*** Same as Alternative 1.
Special-Status Species - Federal ESA-Listed and Proposed Species ***LSI*** Mariana fruit bat, Mariana eight-spot butterfly - implementation of BMPs would avoid and minimize impacts.	Special-Status Species - Federal ESA-Listed and Proposed Species ***LSI*** Mariana fruit bat - no physical disturbance of recovery habitat; temporary live-fire noise impacts to 824 acres (333 ha) of fruit bat recovery habitat; implementation of BMPs would avoid and minimize impacts. Mariana swiftlet - LFTRC noise levels would not impact foraging swiftlets or swiftlet nesting/roosting caves approximately 2 miles (3 km)	Special-Status Species - Federal ESA-Listed and Proposed Species ***LSI*** Mariana fruit bat - no physical disturbance of recovery habitat; temporary live-fire noise impacts to 1,534 acres (621 ha) of fruit bat recovery habitat; implementation of BMPs would avoid and minimize impacts. Mariana swiftlet - LFTRC noise levels would not impact foraging swiftlets or swiftlet nesting/roosting caves approximately 1 mile (1.6	Special-Status Species - Federal ESA-Listed and Proposed Species ***LSI*** Mariana fruit bat - no physical disturbance of recovery habitat; temporary live-fire noise impacts to 1,506 acres (610 ha) of fruit bat recovery habitat; implementation of BMPs would avoid and minimize impacts. Mariana swiftlet - LFTRC noise levels would not impact foraging swiftlets or swiftlet nesting/ roosting caves approximately 1	Special-Status Species - Federal ESA-Listed and Proposed Species and Critical Habitat ***LSI*** Mariana fruit bat - no physical disturbance of recovery habitat; temporary live-fire noise impacts to 1,101 acres (446 ha) of fruit bat recovery habitat; implementation of BMPs would avoid and minimize impacts. Mariana eight-spot butterfly - implementation of BMPs would avoid and minimize impacts.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
	north. Mariana common moorhen - LFTRC noise levels at the closest moorhen nesting area (Fena Reservoir) would be at or below ambient noise levels.	km) north. Mariana common moorhen - LFTRC noise levels at the closest moorhen nesting area (Fena Reservoir) would be at or below ambient noise levels. Mariana eight-spot butterfly - implementation of BMPs would avoid and minimize impacts.	mile (1.6 km) north and 2 miles (3 km) east. Mariana common moorhen - LFTRC noise levels at the closest moorhen nesting area (Fena Reservoir) would be at or below ambient noise levels. Mariana eight-spot butterfly - implementation of BMPs would avoid and minimize impacts.	
NI Mariana crow, Guam rail, Guam Micronesian kingfisher - species no longer occur on Guam, therefore there would be no impacts due to operations of LFTRC. *Serianthes* tree - implementation of BMPs would avoid and minimize impacts.	***NI*** Mariana crow, Guam rail, Guam Micronesian kingfisher - species no longer occur on Guam, therefore there would be no impacts due to operations of LFTRC. *Serianthes* tree - implementation of BMPs would avoid and minimize impacts.	***NI*** Mariana crow, Guam rail, Guam Micronesian kingfisher - species no longer occur on Guam, therefore there would be no impacts due to operations of LFTRC. *Serianthes* tree - implementation of BMPs would avoid and minimize impacts.	***NI*** Mariana crow, Guam rail, Guam Micronesian kingfisher - species no longer occur on Guam, therefore there would be no impacts due to operations of LFTRC. *Serianthes* tree - implementation of BMPs would avoid and minimize impacts.	***NI*** Mariana crow, Guam rail, Guam Micronesian kingfisher - species no longer occur on Guam, therefore there would be no impacts due to operations of LFTRC. Mariana fruit bat, Mariana crow, Guam Micronesian kingfisher critical habitat - No impacts. Mariana eight-spot butterfly- implementation of BMPs would avoid and minimize impacts**.** *Serianthes* tree - implementation of BMPs would avoid and minimize impacts.
Special-Status Species -Guam-Listed and SOGCN ***LSI*** Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. No additional Guam-listed species are known to occur in the project area for this Alternative.	Special-Status Species -Guam-Listed and SOGCN ***LSI*** Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. No additional Guam-listed species are known to occur in the project area for this Alternative.	Special-Status Species -Guam-Listed and SOGCN ***LSI*** Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***LSI*** Pacific slender-toed gecko, *Merrilliodendron megacarpum* - implementation of BMPs would avoid and minimize impacts**.**	Special-Status Species -Guam-Listed and SOGCN ***LSI*** Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. Impacts to other Guam-listed species are described below. ***LSI*** Pacific slender-toed gecko, *Merrilliodendron megacarpum* - implementation of BMPs would avoid and minimize impacts**.**	Special-Status Species -Guam-Listed and SOGCN ***LSI*** Impacts to Guam-listed species that are also federally listed would be the same as described above for those species. No additional Guam-listed species are known to occur in the project area for this Alternative.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Marine Biological Resources				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Marine Flora, Invertebrates, Fish, and EFH ***LSI*** Potential indirect short-term impacts to marine flora, invertebrates, fish and EFH from increased recreational use (damage to reefs typically caused by anchors, reef-walkers, or scuba diving, snorkeling, and fishing activities) would be avoided or minimized to less than significant impacts with the implementation of BMPs. ***NI*** There would be no in-water construction or dredging; therefore, there would be no direct short-term impacts. Stormwater runoff from the project area would not enter nearshore waters, therefore there would be no short-term impacts to marine flora, invertebrates, fish, and EFH associated with construction runoff.	Marine Flora, Invertebrates, Fish, and EFH ***NI*** The project site would be located entirely inland. There would be no-in water or coastal components therefore there would be no direct impacts. Stormwater runoff from the project area would not enter nearshore waters; therefore, there would be no impacts to marine flora, invertebrates, fish, and EFH associated with construction.	Marine Flora, Invertebrates, Fish, and EFH ***NI*** Similar to Alternative 2, the project site would be located entirely inland with no in-water or coastal components. Stormwater runoff from the project area would not enter nearshore waters, therefore, there would be no impacts to marine flora, invertebrates, fish, and EFH associated with construction.	Marine Flora, Invertebrates, Fish, and EFH ***NI*** Similar to Alternative 2, the project site would be located entirely inland with no in-water or coastal components. Stormwater runoff from the project area would not enter nearshore waters; therefore, there would be no impacts to marine flora, invertebrates, fish, and EFH associated with construction.	Marine Flora, Invertebrates, Fish, and EFH ***LSI*** The impacts would be similar to Alternative 1. ***NI*** The impacts would be similar to Alternative 1.
Special-Status Species - Federal ESA-Listed and Proposed Species ***LSI*** Green sea turtle, hawksbill sea turtle - short-term indirect impacts to green sea turtle and hawksbill sea turtle from disturbance resulting from increased activity in the area. Potential indirect impact on special-status species from	Special-Status Species - Federal ESA-Listed and Proposed Species ***NI*** The project site would be located entirely inland. There would be no in-water or coastal components therefore there would be no direct impacts. Stormwater runoff from the project area would not enter nearshore waters; therefore, there	Special-Status Species - Federal ESA-Listed and Proposed Species ***NI*** Similar to Alternative 2, the project site would be located entirely inland with no in-water or coastal components. Stormwater runoff from the project area would not enter nearshore waters.	Special-Status Species - Federal ESA-Listed and Proposed Species ***NI*** Similar to Alternative 2, the project site would be located entirely inland with no in-water or coastal components. Stormwater runoff from the project area would not enter nearshore waters.	Special-Status Species - Federal ESA-Listed and Proposed Species **LSI** Short-term indirect impacts would be similar to Alternative 1. ***NI*** Impacts would be similar to Alternative 1.

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
increased recreational use as mentioned above would be avoided or minimized to less than significant impacts with the implementation of BMPs. ***NI*** There would be no in-water construction or dredging; therefore, there would be no direct impacts to green sea turtles or hawksbill sea turtles associated with construction.	would be no indirect impacts to Special-Status Species - Federal ESA-Listed and Proposed Species.			
Marine Conservation Areas ***NI*** There are no marine conservation areas at or adjacent to the proposed Route 15 LFTRC alternative. Therefore, there would be no impacts to such areas.	Marine Conservation Areas ***NI*** The project site would be located entirely inland. There would be no in water or coastal components; therefore, there would be no direct impacts. Stormwater runoff from the project area would not enter nearshore waters; therefore, there would be no indirect impacts to marine conservation areas.	Marine Conservation Areas ***NI*** Similar to Alternative 2, the project site would be located entirely inland with no in-water or coastal components. Stormwater runoff from the project area would not enter nearshore waters.	Marine Conservation Areas ***NI*** Similar to Alternative 2, the project site would be located entirely inland with no in-water or coastal components. Stormwater runoff from the project area would not enter nearshore waters.	Marine Conservation Areas ***LSI*** Construction activities for the NWF alternative are expected to result in less than significant direct and indirect short-term impacts to conservation efforts and management activities at the Guam NWR - Ritidian Unit with the implementation of BMPs.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Marine Flora and Invertebrates ***LSI*** There would be no in-water training. The small number of rounds that could ricochet outside the range and enter the marine environment would have no direct long-term impacts to marine flora and invertebrates. ***NI*** Stormwater runoff from the range area would not enter nearshore waters; therefore, there would be no long-term impacts to marine flora and invertebrates associated with range runoff.	Marine Flora and Invertebrates ***NI*** The range would be located entirely inland. There would be no-in water or coastal operations components; therefore, there would be no direct impacts. Stormwater runoff from the range area would not enter nearshore waters; therefore, there would be no indirect impacts to marine flora and invertebrates associated with operations.	Marine Flora and Invertebrates ***NI*** The range would be located entirely inland. There would be no-in water or coastal operations components; therefore, there would be no direct impacts. Similar to Alternative 2, stormwater runoff from the range area would not enter nearshore waters, thus there would be no indirect impacts to marine flora and invertebrates.	Marine Flora and Invertebrates ***NI*** The range would be located entirely inland. There would be no-in water or coastal operations components; therefore, there would be no direct impacts. Similar to Alternative 2, stormwater runoff from the range area would not enter nearshore waters, thus there would be no indirect impacts to marine flora and invertebrates.	Marine Flora and Invertebrates ***LSI*** The impacts would be similar to Alternative 1. ***NI*** The impacts would be similar to Alternative 1.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Fish and EFH ***LSI*** There would be no in-water training. The minimal number of rounds that could ricochet outside the range and enter the marine environment would have a less than significant direct, long-term impacts to fish and EFH. ***NI*** Stormwater runoff from the range area would not enter nearshore waters; therefore, there would be no long-term impacts to fish and EFH associated with range runoff.	Fish and EFH ***NI*** The range would be located entirely inland. There would be no-in water or coastal operations components therefore there would be no direct impacts. Stormwater runoff from the range area would not enter nearshore waters, therefore there would be no impacts to fish and EFH associated with operations.	Fish and EFH ***NI*** The range would be located entirely inland. There would be no-in water or coastal operations components therefore there would be no direct impacts. Similar to Alternative 2, stormwater runoff from the range area would not enter nearshore waters, thus there would be no indirect impacts to fish and EFH.	Fish and EFH ***NI*** The range would be located entirely inland. There would be no-in water or coastal operations components therefore there would be no direct impacts. Similar to Alternative 2, stormwater runoff from the range area would not enter nearshore waters, thus there would be no indirect impacts to fish and EFH.	Fish and EFH ***LSI*** The impacts would be similar to Alternative 1. ***NI*** The impacts would be similar to Alternative 1.
Special-Status Species - Federal ESA-Listed and Proposed Species ***LSI*** With use of range safety procedures, range lighting design to minimize impacts to special-status species, and implantation of BMPs, direct impacts to green sea turtles and hawksbill sea turtles would be less than significant. ***NI*** Stormwater runoff from the range area would not enter nearshore waters; therefore, there would be no long-term impacts to green sea turtles and hawksbill sea turtles from range runoff.	Special-Status Species - Federal ESA-Listed and Proposed Species ***NI*** The range would be located entirely inland. There would be no-in water or coastal operations components therefore there would be no direct impacts. Stormwater runoff from the range area would not enter nearshore waters; therefore, there would be no impacts to green sea turtles and hawksbill sea turtles associated with operations.	Special-Status Species - Federal ESA-Listed and Proposed Species ***NI*** The range would be located entirely inland. There would be no-in water or coastal operations components therefore there would be no direct impacts. Similar to Alternative 2, stormwater runoff from the range area would not enter nearshore waters, thus there would be no indirect impacts to green sea turtles and hawksbill sea turtles.	Special-Status Species - Federal ESA-Listed and Proposed Species ***NI*** The range would be located entirely inland. There would be no-in water or coastal operations components therefore there would be no direct impacts. Similar to Alternative 2, stormwater runoff from the range area would not enter nearshore waters, thus there would be no indirect impacts to green sea turtles and hawksbill sea turtles.	Special-Status Species - Federal ESA-Listed and Proposed Species ***LSI*** The impacts would be similar to Alternative 1. ***NI*** The impacts would be similar to Alternative 1.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Marine Conservation Areas ***NI*** There are no marine conservation areas at or adjacent to the proposed Route 15 LFTRC alternative. Therefore, there would be no impacts to such areas.	Marine Conservation Areas ***NI*** The project site would be located entirely inland. There would be no in water or coastal components therefore there would be no direct impacts. Stormwater runoff from the project area would not enter nearshore waters. Therefore, there would be no indirect impacts.	Marine Conservation Areas ***NI*** Similar to Alternative 2, the project site would be located entirely inland with no in-water or coastal components. Stormwater runoff from the project area would not enter nearshore waters. Therefore, there would be no direct or indirect impacts.	Marine Conservation Areas ***NI*** Similar to Alternative 2, the project site would be located entirely inland with no in-water or coastal components. Stormwater runoff from the project area would not enter nearshore waters. Therefore, there would be no direct or indirect impacts.	Marine Conservation Areas ***LSI*** NWF Alternative 5 operational activities would result in less than significant direct and indirect impacts to conservation efforts and management activities at the Guam NWR - Ritidian Unit with the implementation of BMPs and coordination between USFWS and the DON for current or planned research and conservation programs.
Cultural Resources				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
SI-M Potential direct adverse effects to 3 historic properties from excavation and soil removal. Potential impacts to culturally important natural resources from vegetation removal. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA process, including development of an RMP, and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners.**	***SI-M*** Potential direct adverse effects to 9 historic properties. Potential impacts to culturally important natural resources from vegetation removal. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA process, including development of an RMP and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners.**	***SI-M*** Potential direct adverse effects to 11 historic properties from excavation and soil removal. Undetermined effects to 2 unevaluated sites and 1 potential TCP from excavation and soil removal. Potential impacts to culturally important natural resources from vegetation removal. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA process, including development of an RMP, and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners.**	***SI-M*** Potential direct adverse effects to 11 historic properties from excavation and soil removal. Potential impacts to culturally important natural resources from vegetation removal. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA process, including development of an RMP and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners.**	***SI-M*** Potential direct adverse effects to 20 historic properties. Potential impacts to culturally important natural resources from vegetation removal. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA process, including development of an RMP, and coordination with SHPO, concurring parties, and knowledgeable traditional practitioners.**

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
SI-M Potential indirect adverse effects to 1 NRHP-eligible site/potential TCP from changes in use that degrade site integrity. Potential indirect adverse effects to 1 NRHP-eligible archaeological site/potential TCP from recreational use and visual intrusion. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA with implementation of an RMP, coordination with SHPO and concurring parties, and Cultural Resources Awareness briefs.**	***SI-M*** Potential indirect adverse effects to 2 NRHP-eligible sites from changes in use that degrade site integrity. Undetermined effects to 2 unevaluated sites from changes in use that degrade site integrity. Potential indirect effects to 1 potential TCP from restricted access. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA with implementation of an RMP to include consideration for access and coordination with SHPO and concurring parties.**	***SI-M*** Potential indirect adverse effects to 25 NRHP-eligible sites and indirect effects to 2 potential TCPs from changes in use that degrade site integrity. Potential indirect effects to 5 potential TCPs from restricted access. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA with implementation of an RMP to include consideration for access and coordination with SHPO and concurring parties.**	***SI-M*** Potential indirect adverse effects to 24 historic properties from changes in use that degrade site integrity. Potential indirect effects to 4 potential TCPs from restricted access. Undetermined effects to 5 unevaluated sites and 2 potential TCPs from changes in use that degrade site integrity. ***Potential Mitigation Measures*** **Proposed mitigation through 2011 PA with implementation of an RMP to include consideration for access and coordination with SHPO and concurring parties.**	***SI*** Potential adverse impacts to 2 NRHP-eligible archaeological sites from restricted access. ***SI-M*** Potential indirect adverse effects to 3 NRHP-eligible sites from changes in use that degrade site integrity. ***Potential Mitigation Measures*** **Proposed partial mitigation through 2011 PA with implementation of an RMP to include consideration for access and coordination with SHPO and concurring parties.**
Visual Resources				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
LSI Visual impacts would be direct, short-term, and less than significant.	***LSI*** Same as Alternative 1.	***LSI*** Same as Alternative 1.	***LSI*** Same as Alternative 1.	***LSI*** Same as Alternative 1.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
SI-M While the visual landscape would be substantially altered during the construction phase, Alternative 1 would not result in significant negative visual impacts. Over time, the graded and replanted areas would blend with the surrounding topography and eventually, the surrounding vegetative cover. The realigned Route 15 would traverse the same type of fast-growing scrub forest areas as	***LSI*** Less than significant direct, long-term impact due to limited scale of proposed development, and a lack of visibility from Mount Lamlam and Mount Jumullong Manglo Overlook.	***SI*** Direct, long-term impact from Alternative 3 facilities being visible from Jumullong Manglo Overlook as well as from the trails leading up to the Overlook and near the top of Mount Lamlam. The elevation of both Mount Lamlam (the highest point on Guam) and Jumullong Manglo Overlook could result in the ability to see portions of the 3 miles (5 km) of new roadways,	***SI*** Direct, long-term impact from Alternative 4 facilities being visible from Jumullong Manglo Overlook as well as from the trails leading up to the Overlook and near the top of Mount Lamlam. The elevation of both Mount Lamlam (the highest point on Guam) and Jumullong Manglo Overlook could result in the ability to see portions of the 1 mile (2 km) of new roadways, areas of removed vegetation and	***LSI*** There would be a less than significant long-term direct impact from this alternative due to flat topography, dense vegetation and limited public access for viewing the proposed LFTRC facilities.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
those bordering the existing road and would produce the same type of visual experience as those from the current route. ***Potential Mitigation Measures*** **To maintain the existing visual appearance, land clearing and grading should be minimized to the extent possible on lands proposed for range uses.** **Minimize impact by using native flora to create a natural-appearing "screen" around the cleared range areas, outside of the firebreaks/perimeter roads.**		areas of removed vegetation and cut/fill features, earthen berms as well as some of the proposed structures, including some of the 72 relocated ordnance magazines. ***Potential Mitigation Measures*** **Same as Alternative 1.**	cut/fill features, earthen berms as well as some of the proposed structures including some of the 66 relocated ordnance magazines. ***Potential Mitigation Measures*** **Same as Alternative 1.**	
Ground Transportation				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
LSI Short-term, direct impacts from construction workers and construction-related vehicle trips resulting in congestion on on-base roadways. Implementation of appropriate work zone traffic management strategies and BMPs would minimize impacts. Potential direct and indirect impacts to ground transportation resources from construction would be minimized with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, there would be less than significant short-term impacts to on-base (internal) roadways.	***LSI*** Similar to Alternative 1.	***LSI*** Similar to Alternative 1.	***LSI*** Similar to Alternative 1.	***LSI*** Similar to Alternative 1.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Internal (range) Roadways ***NI*** No impacts to internal roadway segments would occur, because all internal (range) roadway segments would be designed with the capacity required to accommodate the expected travel demand on the facilities.	Internal (range) Roadways ***NI*** Similar to Alternative 1.	Internal (range) Roadways ***NI*** Similar to Alternative 1.	Internal (range) Roadways ***NI*** Similar to Alternative 1.	Internal (range) Roadways ***NI*** Similar to Alternative 1.
Marine Transportation				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
NI Construction for the project takes place on shore with no in-water or coastal components; therefore, there would be no impacts to marine transportation during construction.	***NI*** LFTRC and associated SDZ do not extend over water used by vessels.	***NI*** Same as Alternative 2.	***NI*** Same as Alternative 2.	***NI*** Similar to Alternative 1, but would likely affect more marine vessels.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
LSI Direct impact from full- or part-time closure of the SDZ will exclude vessels from entering. Through the use of live-fire observation, mariner notification, and chart updates to include the SDZ, impacts to marine transportation would be less than significant during operation.	***NI*** LFTRC and associated SDZ do not extend over water used by vessels.	***NI*** Same as Alternative 2.	***NI*** Same as Alternative 2.	***LSI*** Similar to Alternative 1.

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Utilities				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
LSI Users may experience short-term construction outages with electrical power, potable water, wastewater systems, and IT/COMM systems during construction. Advance notice and other measures would minimize impacts. There would be short-term, direct impact to the solid waste handling due to increases of waste during construction.	***LSI*** Short-term, direct impacts to utilities would be similar to that described for Alternative 1.	***LSI*** Short-term, direct impacts to utilities would be similar to that described for Alternative 1.	***LSI*** Short-term, direct impacts to utilities would be similar to that described for Alternative 1.	***LSI*** Short-term, direct impacts to utilities would be similar to that described for Alternative 1.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
LSI Increased demand for electrical, potable water, wastewater, solid waste, and IT/COMM utility would be low. Proposed improvements to all utilities have been developed to meet the requirements for the proposed action. Therefore, short- and long-term direct impacts would be less than significant.	***LSI*** Short- and long-term, direct impacts would similar to that described for Alternative 1.	***LSI*** Short- and long-term, direct impacts would similar to that described for Alternative 1.	***LSI*** Short- and long-term, direct impacts would similar to that described for Alternative 1.	***LSI*** Short- and long-term, direct impacts would similar to that described for Alternative 1.
Socioeconomics and General Services				
Construction and Operation Impacts	**Construction and Operation Impacts**	**Construction and Operation Impacts**	**Construction and Operation Impacts**	**Construction and Operation Impacts**
Sociocultural Impacts of Land Acquisition ***LSI*** None of the lots to be potentially acquired are privately owned. There would be adverse short- and long-term, indirect impacts from a sociocultural perspective due to the potential for the loss of the	Sociocultural Impacts of Land Acquisition ***LSI*** Of the 19 lots to potentially be acquired, 17 are known to be privately owned and one lot has unknown ownership, so up to 18 different private parties could be affected. Should condemnation be necessary as a last resort,	Sociocultural Impacts of Land Acquisition ***LSI*** Of the 23 lots to potentially be acquired, 4 are known to be privately owned and 17 lots have unknown ownership, so up to 21 different private parties could be affected. It is anticipated that, in all cases, a negotiated sale or	Sociocultural Impacts of Land Acquisition ***LSI*** Of the 30 lots to potentially be acquired, 9 are privately owned and 18 have unknown ownership, so up to 27 different private parties could be affected. It is anticipated that, in all cases, a negotiated sale or lease	Sociocultural Impacts of Land Acquisition ***LSI*** Alternative 5 would not require federal land acquisition. There would be long-term indirect sociocultural impacts from restricted access due to the potential that access restrictions will deteriorate social networks; i.e. if groups of people currently (or

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
raceway park. Since groups of people currently use the raceway park for social gatherings, if these gatherings ceased then the related social networks may lose cohesiveness. Feelings of injustice may arise from deterioration of social networks.	while the landowner would be made economically whole by payment of fair market value, such an occurrence could represent an adverse long-term sociocultural impact for that individual landowner. Such instances are expected to be extremely rare or nonexistent during implementation of this alternative, and collectively would not represent a significant impact.	lease between the federal government and a willing seller would be arranged, and there would be no adverse sociocultural impact. In the unlikely event that the land was acquired through condemnation, it is possible that the individual landowner would potentially consider the forced sale or lease of property to be an adverse impact (despite being paid fair market value). Such instances are expected to be extremely rare or nonexistent during implementation of this alternative, and collectively would not represent a significant impact.	between the federal government and a willing seller would be arranged, and there would be no adverse sociocultural impact. In the unlikely event that the land was acquired through condemnation, it is possible that the individual landowner would potentially consider the forced sale or lease of property to be an adverse impact (despite being paid fair market value). Such instances are expected to be extremely rare or nonexistent during implementation of this alternative, and collectively would not represent a significant impact.	traditionally) use areas that would be restricted to hold social gatherings, then the access restrictions could impact those groups by deteriorating the social networks inherent in those groups. Also, as social networks may deteriorate due to the access restrictions, feelings of injustice may arise. While there is potential for social networks to deteriorate, it is not a certainty. Given the presence of other public recreation areas nearby, potential impacts are determined to be less than significant.
Economic Impacts of Land Acquisition ***LSI*** There would be a direct reduction in revenue to GovGuam of $472,000 over the 2015-2018 period resulting in lost license/lease revenue from the Guam International Raceway and the coral quarry. However, because the land acquisition process would compensate for highest and best use, there would be no impact to GovGuam associated with this loss of revenue.	Economic Impacts of Land Acquisition ***LSI*** There would be a reduction of 33 acres (13 ha) of prime farmlands, leading to a potential reduction of up to $263,500/year in property tax revenue and resulting in an adverse but less than significant impact. However, the 360 acres (146 ha) of GovGuam land subject to acquisition are not currently generating income, so a sale or lease of those lands would generate a small beneficial direct economic effect.	Economic Impacts of Land Acquisition ***LSI*** There could be a potential reduction of up to $27,436/year in property tax revenue from acquisition of privately owned parcels. However, the 360 acres (146 ha) of GovGuam land subject to acquisition are not currently generating income, so a sale or lease of those lands would generate a small beneficial direct economic effect.	Economic Impacts of Land Acquisition ***LSI*** There could be a potential reduction of up to $122,000/year in property tax revenue from acquisition of privately owned parcels. However, the 205 acres (83 ha) of GovGuam land subject to acquisition are not currently generating income, so a sale or lease of those lands would generate a small beneficial direct economic effect.	Economic Impacts of Land Acquisition ***NI*** Alternative 5 would not involve acquisition of non-federal land and would therefore have no economic impact relative to land acquisition.

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Hazardous Materials and Waste				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Hazardous Materials and Hazardous Waste Management ***LSI*** Less than significant, direct, short-term increase in the use, transport, storage and handling of hazardous materials and hazardous waste during construction. Use of BMPs and SOPs to minimize potential for accidental releases and implement timely cleanup would reduce impacts to a less than significant level.	Hazardous Materials and Hazardous Waste Management ***LSI*** Range construction activities for Alternative 2 would be similar to those for Alternative 1. Construction of Alternative 2 ranges would use similar types and volumes of hazardous materials and would generate similar volumes of hazardous wastes. Use of BMPs and SOPs to minimize potential for accidental releases and implement timely cleanup would reduce impacts to a less than significant level.	Hazardous Materials and Hazardous Waste Management ***LSI*** Range construction activities for Alternative 3 would be similar to those for Alternative 1. Construction of Alternative 3 ranges would use similar types and volumes of hazardous materials and would generate similar volumes of hazardous wastes. Use of BMPs and SOPs to minimize potential for accidental releases and implement timely cleanup would reduce impacts to a less than significant level.	Hazardous Materials and Hazardous Waste Management ***LSI*** Range construction activities for Alternative 4 would be similar to those for Alternative 1. Construction of Alternative 4 ranges and would use similar types volumes of hazardous materials and would generate similar volumes of hazardous wastes. Use of BMPs and SOPs to minimize potential for accidental releases and implement timely cleanup would reduce impacts to a less than significant level.	Hazardous Materials and Hazardous Waste Management ***LSI*** Range construction activities for Alternative 5 would be similar to those for Alternative 1. Construction of Alternative 5 ranges would use similar types and volumes of hazardous materials and would generate similar volumes of hazardous wastes. Use of BMPs and SOPs to minimize potential for accidental releases and implement timely cleanup would reduce impacts to a less than significant level.
Contaminated Sites ***NI*** Contaminated sites were determined to either be outside of the proposed construction area and would have no direct or indirect impact on site conditions, or have been investigated and determined to pose no risk to human health or environmental receptors.	Contaminated Sites ***NI*** There are no contaminated sites in the proposed Alternative 2 site area; therefore, there would be no impacts.	Contaminated Sites ***NI*** Contaminated sites were determined to either be outside of the proposed construction area and would have no direct or indirect impact on site conditions, or have been investigated and determined to pose no risk to human health or environmental receptors.	Contaminated Sites ***NI*** Contaminated sites were determined to either be outside of the proposed construction area and would have no direct or indirect impact on site conditions, or have been investigated and determined to pose no risk to human health or environmental receptors.	Contaminated Sites ***LSI*** There are two IRP and five potentially contaminated sites within the proposed development footprint. Contaminated sites would be avoided to the maximum extent practicable. If avoidance is not possible, active sites would be appropriately remediated in accordance with CERCLA prior to construction activities. No Further Action sites would be developed in accordance with land use controls, if any.
Toxic Substances ***LSI*** Suspected LBP, ACM, and PCBs in existing structures on the Alternative 1 site would be properly surveyed, managed, and materials disposed of in	Toxic Substances ***NI*** There are no structures in the Alternative 2 site, so no LBP, ACM, or PCBs would be present to be encountered during demolition. No such materials	Toxic Substances ***LSI*** There are existing structures on the Alternative 3 site, so suspected LBP, ACM, and PCBs would be properly surveyed, managed, and materials disposed	Toxic Substances ***LSI*** There are existing structures on the Alternative 4 site, so suspected LBP, ACM, and PCBs would be properly surveyed, managed, and materials disposed	Toxic Substances ***LSI*** There are existing structures on the Alternative 5 site, so potential LBP, ACM, and PCBs would be properly surveyed, managed, and materials disposed of in accordance with

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
accordance with existing laws and regulations. No LBP, ACM, and PCBs would be used in new construction. Because the Alternative 1 site is located in a USEPA Radon Zone 1, it is possible that new buildings, facilities, and structures could encounter radon intrusion. To minimize this impact, radon resistant construction techniques and mitigation systems would be incorporated into the building/facility designs. In addition, DoD would periodically test facilities constructed in known radon zones to verify that no unacceptable radon gas buildup occurs and install radon mitigation systems as appropriate.	would be used in the new construction. Therefore, there would be no direct or indirect impacts. The site is in a USEPA Radon Zone 3, where radon intrusion into structures would be unlikely. Therefore, there would be no radon toxic substances impacts with construction of Alternative 2.	of in accordance with existing laws and regulations. No LBP, ACM, and PCBs would be used in new construction. Therefore, impacts would be less than significant. ***NI*** The Alternative 3 site is in a USEPA Radon Zone 3, where radon intrusion into structures would be unlikely. Therefore, there would be no radon toxic substances impacts with construction of Alternative 3	of in accordance with existing laws and regulations. No LBP, ACM, and PCBs would be used in new construction. Therefore, impacts would be less than significant. ***NI*** The Alternative 4 site is in a USEPA Radon Zone 3, where radon intrusion into structures would be unlikely. Therefore, there would be no radon toxic substances impacts with construction of Alternative 3	existing laws and regulations. No LBP, ACM, and PCBs would be used in new construction. Therefore, impacts would be less than significant. Because the Alternative 5 site is located in a USEPA Radon Zone 1, it is possible that new buildings, facilities, and structures could encounter radon intrusion. To minimize this impact, radon resistant construction techniques and mitigation systems would be incorporated into the building/facility designs. In addition, DoD would periodically test facilities constructed in known radon zones to verify that no unacceptable radon gas buildup occurs and install radon mitigation systems as appropriate.
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Hazardous Materials Management ***LSI*** A direct, long-term increase in hazardous materials use volume of 640 pounds (290 kg) per year is anticipated. Range clearance, erosion control measures, and BMPs would minimize runoff from MEC and reduce impacts to a less than significant level.	Hazardous Materials Management ***LSI*** The range operations for Alternative 2 would be similar to Alternative 1; therefore, the long-term increase in volume of hazardous materials used would similar to Alternative 1. The same range clearance and erosion control measures and BMPs would be used to reduce impacts to a less than significant level.	Hazardous Materials Management ***LSI*** The range operations for Alternative 3 would be similar to Alternative 1; therefore, the long-term increase in volume of hazardous materials used would similar to Alternative 1. The same range clearance and erosion control measures and BMPs would be used to reduce impacts to a less than significant level.	Hazardous Materials Management ***LSI*** The range operations for Alternative 4 would be similar to Alternative 1; therefore, the long-term increase in volume of hazardous materials used would similar to Alternative 1. The same range clearance and erosion control measures and BMPs would be used to reduce impacts to a less than significant level.	Hazardous Materials Management ***LSI*** The range operations for Alternative 5 would be similar to Alternative 1; therefore, the long-term increase in volume of hazardous materials used would similar to Alternative 1. The same range clearance and erosion control measures and BMPs would be used to reduce impacts to a less than significant level.

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Hazardous Waste Management ***LSI*** A direct long-term increase in hazardous waste volume of 12,880 pounds (5,542 kg) per year is anticipated. Satellite hazardous waste accumulation sites would be created on DoD property, and managed in accordance with applicable regulations, therefore, impacts would be less than significant.	Hazardous Waste Management ***LSI*** The range operations for Alternative 2 would be similar to Alternative 1; therefore, the long-term increase in volume of hazardous waste generated would similar to Alternative 1. As with Alternative 1, satellite hazardous waste accumulation sites would be created on DoD property, and managed in accordance with applicable regulations, therefore, impacts would be less than significant.	Hazardous Waste Management ***LSI*** The range operations for Alternative 3 would be similar to Alternative 1; therefore, the long-term increase in volume of hazardous waste generated would similar to Alternative 1. As with Alternative 1, satellite hazardous waste accumulation sites would be created on DoD property, and managed in accordance with applicable regulations, therefore, impacts would be less than significant.	Hazardous Waste Management ***LSI*** The range operations for Alternative 4 would be similar to Alternative 1; therefore, the long-term increase in volume of hazardous waste generated would similar to Alternative 1. As with Alternative 1, satellite hazardous waste accumulation sites would be created on DoD property, and managed in accordance with applicable regulations, therefore, impacts would be less than significant.	Hazardous Waste Management ***LSI*** The range operations for Alternative 5 would be similar to Alternative 1; therefore, the long-term increase in volume of hazardous waste generated would similar to Alternative 1. As with Alternative 1, satellite hazardous waste accumulation sites would be created on DoD property, and managed in accordance with applicable regulations, therefore, impacts would be less than significant.
Contaminated Sites ***NI*** Contaminated sites were determined to either be outside of the proposed construction area and would have no direct or indirect impact on site conditions, or have been investigated and determined to pose no risk to human health or environmental receptors.	Contaminated Sites ***NI*** There are no contaminated sites in the proposed Alternative 2 site area; therefore, there would be no impacts.	Contaminated Sites ***NI*** Contaminated sites were determined to either be outside of the proposed construction area and would have no direct or indirect impact on site conditions, or have been investigated and determined to pose no risk to human health or environmental receptors.	Contaminated Sites ***NI*** Contaminated sites were determined to either be outside of the proposed construction area and would have no direct or indirect impact on site conditions, or have been investigated and determined to pose no risk to human health or environmental receptors.	Contaminated Sites ***LSI*** Contaminated sites (IRP and MMRP) identified under this alternative have been investigated and determined to pose no risk to human health or environmental receptors or would be investigated and remediated prior to facility construction to ensure than no health hazards would be present during site operations. Therefore, the impacts to IRP/MMRP sites under this alternative would be less than significant.
Toxic Substances ***LSI*** Suspected LBP, ACM and PCBs would be properly surveyed, managed and materials disposed of in accordance with existing laws and regulations. No LBP, ACM and PCBs would be used in new construction. Therefore, there would be less than significant direct or indirect impacts to	Toxic Substances ***NI*** No LBP, ACM and PCBs would be used in new construction. No such materials would be present; therefore, there would be no impact. The site is in a USEPA Radon Zone 3, where radon intrusion into structures would be unlikely. Therefore, there would be no toxic substances impacts with operation of Alternative 2.	Toxic Substances ***LSI*** Suspected LBP, ACM, and PCBs would be properly surveyed, managed and materials disposed of in accordance with existing laws and regulations. No LBP, ACM and PCBs would be used in new construction. Therefore, impacts would be less than significant.	Toxic Substances ***LSI*** Suspected LBP, ACM, and PCBs would be properly surveyed, managed and materials disposed of in accordance with existing laws and regulations. No LBP, ACM and PCBs would be used in new construction. Therefore, impacts would be less than significant.	Toxic Substances ***LSI*** Suspected LBP, ACM and PCBs would be properly surveyed, managed and materials disposed of in accordance with existing laws and regulations. No LBP, ACM and PCBs would be used in new construction. Therefore, impacts would be less than significant. Because the Alternative 5 site is located in a USEPA Radon Zone 1, it

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
human health and the environment. Because the Alternative 1 site is located in a USEPA Radon Zone 1, it is possible that new buildings, facilities, and structures could encounter radon intrusion. To minimize this impact, radon resistant construction techniques and mitigation systems would be incorporated into the building/facility designs. In addition, DoD would periodically test facilities constructed in known radon zones to verify that no unacceptable radon gas buildup occurs and install radon mitigation systems as appropriate. Therefore, direct and indirect impacts would be less than significant.		***NI*** The Alternative 3 site is in a USEPA Radon Zone 3, where radon intrusion into structures would be unlikely. Therefore, there would be no radon toxic substances impacts with construction of Alternative 3.	***NI*** The Alternative 4 site is in a USEPA Radon Zone 3, where radon intrusion into structures would be unlikely. Therefore, there would be no radon toxic substances impacts with construction of Alternative 3.	is possible that new buildings, facilities, and structures could encounter radon intrusion. To minimize this impact, radon resistant construction techniques and mitigation systems would be incorporated into the building/facility designs. In addition, DoD would periodically test facilities constructed in known radon zones to verify that no unacceptable radon gas buildup occurs and install radon mitigation systems as appropriate.
Public Health and Safety				
Construction Impacts	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**	**Construction Impacts**
Operational Safety ***NI*** Similar to the cantonment alternatives in Chapter 4, no impacts to public, military personnel, or worker safety are expected from potential construction hazards because a health and safety program would be implemented for construction contractors and the public would be excluded from construction areas.	Operational Safety ***NI*** Similar to Alternative 1, there would be no impacts from potential construction hazards.	Operational Safety ***NI*** Similar to Alternative 1, there would be no impacts from potential construction hazards.	Operational Safety ***NI*** Similar to Alternative 1, there would be no impacts from potential construction hazards.	Operational Safety ***NI*** Similar to Alternative 1, there would be no impacts from potential construction hazards.

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Environmental Health Effects ***LSI*** Similar to the cantonment alternatives in Chapter 4, there would be less than significant impacts associated with short-term noise and minimal risk of groundwater contamination during construction of the LFTRC.	Environmental Health Effects ***LSI*** Similar to Alternative 1, there would be less than significant impacts associated with short-term noise and minimal risk of groundwater contamination during construction.	Environmental Health Effects ***LSI*** Similar to Alternative 1, there would be less than significant impacts associated with short-term noise and minimal risk of groundwater contamination during construction.	Environmental Health Effects ***LSI*** Similar to Alternative 1, there would be less than significant impacts associated with short-term noise and minimal risk of groundwater contamination during construction.	Environmental Health Effects ***LSI*** Similar to Alternative 1, there would be less than significant impacts associated with short-term noise and minimal risk of groundwater contamination during construction.
Hazardous Substances ***NI*** No impacts expected because hazardous substance management and investigative/cleanup activities would be conducted in accordance with applicable regulations and established BMPs and SOPs.	Hazardous Substances ***NI*** Same as Alternative 1.	Hazardous Substances ***NI*** Same as Alternative 1.	Hazardous Substances ***NI*** Same as Alternative 1.	Hazardous Substances ***NI*** Same as Alternative 1.
Unexploded Ordnance ***LSI*** Because UXO would be identified and removed prior to initiating construction activities and construction personnel would be trained to avoid the hazards associated with unexploded military munitions, potential direct impacts from encounters with UXO would be minimized and less than significant.	Unexploded Ordnance ***LSI*** Same as Alternative 1.	Unexploded Ordnance ***LSI*** Same as Alternative 1.	Unexploded Ordnance ***LSI*** Same as Alternative 1.	Unexploded Ordnance ***LSI*** Same as Alternative 1.
Traffic Incidents ***LSI*** Potential for a small increase in the number of traffic accidents, primarily during operation because of the increase in population, but potentially also during construction activities.	Traffic Incidents ***LSI*** Same as Alternative 1.	Traffic Incidents ***LSI*** Same as Alternative 1.	Traffic Incidents ***LSI*** Same as Alternative 1.	Traffic Incidents ***LSI*** Same as Alternative 1.

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Operation Impacts	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**	**Operation Impacts**
Operational Safety ***LSI*** Impacts from munitions operations/storage would have less than significant, long-term, direct impacts because ordnance and munitions would be managed by trained and qualified personnel in accordance with Marine Corps explosive safety directives.	Operational Safety ***LSI*** Same as Alternative 1.	Operational Safety ***LSI*** Same as Alternative 1. In addition, an explosive safety review and compliance with established safety directives would help to ensure that safety impacts associated with relocating existing munitions magazines that are incompatible with proposed LFTRC development and use under this alternative would be less than significant.	Operational Safety ***LSI*** Same as Alternative 1. In addition, an explosive safety review and compliance with established safety directives would help to ensure that safety impacts associated with relocating existing munitions magazines that are incompatible with proposed LFTRC development and use under this alternative would be less than significant.	Operational Safety ***LSI*** Same as Alternative 1
Environmental Health Effects ***LSI*** Based on the modeled noise levels for proposed LFTRC activities, the overall direct or indirect noise impacts on public health and safety would be less than significant. Because measures would be taken to maintain a sustainable water supply and water well locations would be protected from future development and operational activities, public health and safety impacts from increased demand for potable water and potential water-related illnesses would be less than significant.	Environmental Health Effects ***LSI*** Same as Alternative 1.	Environmental Health Effects ***LSI*** Same as Alternative 1.	Environmental Health Effects ***LSI*** Same as Alternative 1.	Environmental Health Effects ***LSI*** Same as Alternative 1.

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Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Hazardous Substances ***LSI*** Less than significant direct impacts from firing range activities (i.e., exposure to airborne toxic dust) because range maintenance procedures ensure that participating personnel are not exposed to airborne contaminants above permissible limits and analysis of firing range emissions are below significance criteria. ***NI*** No impacts from handling and use of hazardous substances expected because hazardous materials management and investigative/cleanup activities would be conducted in accordance with applicable regulations and established BMPs and SOPs.	Hazardous Substances ***LSI*** Same as Alternative 1.	Hazardous Substances ***LSI*** Same as Alternative 1.	Hazardous Substances ***LSI*** Same as Alternative 1.	Hazardous Substances ***LSI*** Same as Alternative 1.
Unexploded Ordnance ***LSI*** Less than significant direct or indirect impacts from potential contact with UXO because unauthorized personnel would not be allowed on the ranges at any time, training areas would be cleared after live-fire events, and applicable BMPs and safety measures would be implemented.	Unexploded Ordnance ***NI*** Same as Alternative 1.	Unexploded Ordnance ***NI*** Same as Alternative 1.	Unexploded Ordnance ***NI*** Same as Alternative 1.	Unexploded Ordnance ***NI*** Same as Alternative 1.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Traffic Incidents ***LSI*** Potential increase in illegal racing on local roadways and a minimal potential increase in the number of traffic accidents as a result of the increase in island population. Corresponding impacts to public health and safety would be less than significant.	Traffic Incidents ***LSI*** Same as Alternative 1 except that there would be no potential increase in illegal racing on local roadways due to removal of the Guam International Raceway.	Traffic Incidents ***LSI*** Same as Alternative 1 except that there would be no potential increase in illegal racing on local roadways due to removal of the Guam International Raceway.	Traffic Incidents ***LSI*** Same as Alternative 1 except that there would be no potential increase in illegal racing on local roadways due to removal of the Guam International Raceway.	Traffic Incidents ***LSI*** Same as Alternative 1 except that there would be no potential increase in illegal racing on local roadways due to removal of the Guam International Raceway.
Environmental Justice and the Protection of Children				
Construction and Operation Impacts	**Construction and Operation Impacts**	**Construction and Operation Impacts**	**Construction and Operation Impacts**	**Construction and Operation Impacts**
Noise ***LSI*** Special-status populations would not be disproportionately affected by construction- or operation-related noise impacts from the Route 15 LFTRC alternative because the entire region has minority, low-income, and child populations. All residents within the area of noise impacts for this alternative would be affected in the same manner, resulting in less than significant short-term direct impacts.	Noise ***NI*** There would be no impact due to construction or operational noise under this alternative because the LFTRC activities would be in an unpopulated area of Guam. The nearest noise receptors would be at least 1 mile (1.6 km) away from the proposed LFTRC location.	Noise ***NI*** Similar to Alternative 2, due to the lack of populated areas and sensitive receptors in the area.	Noise ***NI*** Similar to Alternative 2, due to the lack of populated areas and sensitive receptors in the area.	Noise ***NI*** Similar to Alternative 2, due to the lack of populated areas and sensitive receptors in the area.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Recreation ***LSI*** The loss of the Raceway would have long-term adverse effect on recreational and sociocultural resources. However, all people of Guam would be affected by impacts to recreational resources; therefore, Alternative 1 would not result in disproportionately high and adverse effects on minority or low-income populations nor would there be disproportionate risks to the health and safety of children.	Recreation ***LSI*** Similar to Alternative 1, since the impact to recreational resources would affect all people of Guam.	Recreation ***LSI*** Similar to Alternative 1, since the impact to recreational resources would affect all people of Guam.	Recreation ***LSI*** Similar to Alternative 1, since the impact to recreational resources would affect all people of Guam.	Recreation ***LSI*** Similar to Alternative 1, since the impact to recreational resources would affect all people of Guam.
Land Acquisition ***LSI*** Low-income populations would not experience disproportionately high and adverse effects due to land acquisition because federal regulations regarding land acquisition would ensure that significant economic impacts to landowners and occupants do not occur. Land acquisition would also not result in health and safety risks that would disproportionately impact children. Therefore, Alternative 1 would not result in disproportionate land use or socioeconomic impacts to minority and low-income populations or children as a result of land acquisition, and impacts would be indirect and less than significant.	Land Acquisition ***LSI*** Similar to Alternative 1, since the proposed land acquisition would not disproportionately affect minority, low-income, and child populations.	Land Acquisition ***LSI*** Similar to Alternative 1, since the proposed land acquisition would not disproportionately affect minority, low-income, and children populations.	Land Acquisition ***LSI*** Similar to Alternative 1, since the proposed land acquisition would not disproportionately affect minority, low-income, and children populations.	Land Acquisition ***NI*** No environmental justice impacts from land acquisition, since there would be no acquisition under Alternative 5.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 5.7-1. Summary of Impacts and Potential Mitigation Measures for the LFTRC Alternatives

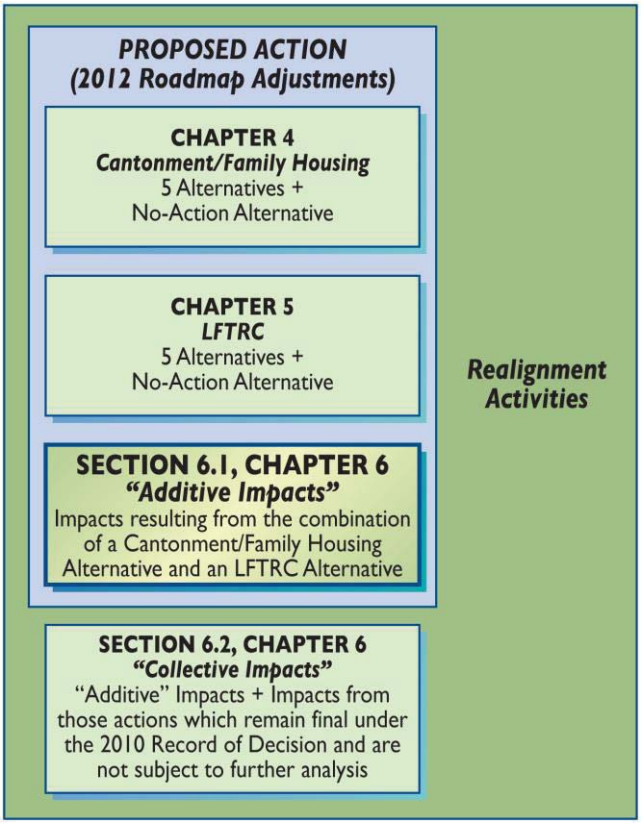
Route 15 (Alternative 1)	***NAVMAG East/West (Alternative 2)***	***NAVMAG North/South (Alternative 3)***	***NAVMAG L-Shaped (Alternative 4)***	***NWF (Alternative 5)***
Public Health and Safety ***LSI*** No impacts to public health and safety are anticipated from management of hazardous substances, and an additional demand to public health services (e.g., hospitals, and outpatient clinics) is not anticipated, resulting in less than significant long-term direct and indirect impacts. Less than significant impacts to public safety are anticipated from operational safety concerns (i.e., explosive safety, electromagnetic safety, and construction safety). Less than significant indirect long-term impacts to public safety from firing range air emissions are anticipated. Less than significant impacts are anticipated from noise, water quality, and UXO. Impacts would not be disproportionate because regardless of where the LFTRC is located on Guam, high (relative to the U.S.) percentages of minorities, low-income residents, and children would not be affected.	Public Health and Safety ***LSI*** Similar to Alternative 1, because regardless of where the LFTRC is located on Guam, high (relative to the U.S.) percentages of minorities, low-income residents, and children would be affected, so impacts cannot be considered disproportionate.	Public Health and Safety ***LSI*** Similar to Alternative 1.	Public Health and Safety ***LSI*** Similar to Alternative 1.	Public Health and Safety ***LSI*** Similar to Alternative 1.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant impact; ***NI*** = no impact; ***BI*** = beneficial impact.

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CHAPTER 6
ADDITIVE AND COLLECTIVE IMPACTS

This chapter presents two sections that evaluate the following additive and collective impacts of the Marine Corps relocation to Guam:



- Section 6.1 addresses additive impacts of the SEIS proposed action that would result specifically from the combination of a cantonment/family housing alternative with an LFTRC alternative. For example, traffic impacts associated with project-related vehicle trips between cantonment/family housing facilities and range facilities would depend on which pair of respective site alternatives is considered. Similarly, the routing of proposed new IT/COMM infrastructure to connect the ranges and the cantonment area (as described in Section 2.6 of this SEIS) would vary depending on the specific combination of cantonment and LFTRC alternatives. These project components were not addressed in Chapter 4 (cantonment impacts) or Chapter 5 (LFTRC impacts) because they would be a function of the combination of alternatives rather than any individual site alternative. Section 6.1 focuses only on those resources for which these types of additive impacts would be applicable.
- Section 6.2 addresses the "collective" impacts attributable to the overall Marine Corps relocation to Guam, which includes not only the re-analyzed actions in the 2012 Roadmap Adjustments (assessed in Chapters 4 and 5 and 6.1 of this SEIS), but also the Marine Corps relocation projects that were fully considered and analyzed in the 2010 Final EIS and remain final from the 2010 ROD, and thus do not require further analysis in this SEIS (hereinafter "2010 ROD-Related Actions").

Unlike the preceding Chapters 4 and 5, this chapter does not contain a section pertaining to the No-Action Alternative. The No-Action Alternative for this SEIS (see Sections 2.1 and 4.5) already corresponds to the complete set of Marine Corps relocation projects that were selected for implementation in the 2010 ROD. Therefore, the collective impacts of implementing the No-Action Alternative were already analyzed in the 2010 Final EIS and summarized in the 2010 ROD.

6.1 ADDITIVE IMPACTS FROM COMBINED ALTERNATIVES

As explained above, this section focuses on the additive impacts of the SEIS proposed action that were not previously addressed in Chapters 4 and 5 because they are a product of the combination of cantonment/family housing and LFTRC site alternatives. These additive impacts may result from construction of the connecting IT/COMM infrastructure described in Section 2.6 of this SEIS, from an increase in traffic on roads connecting a cantonment/family housing area with an LFTRC, or from other characteristics of an alternative site combination.

The following nine resource areas would not be subject to additive impacts from IT/COMM installation, an increase in traffic, or any other factors associated solely with the combination of specific cantonment/ family housing and LFTRC alternatives: airspace, recreation, marine biological resources, visual resources, marine transportation, utilities, land and submerged land use, socioeconomics and general services, and environmental justice. These resources are therefore not discussed further in this section.

Section 6.1.1 addresses short-term and less than significant additive impacts that would occur during construction of the IT/COMM links but would not vary appreciably with specific site combinations. Such impacts apply to geological and soil resources, water resources, noise, ground transportation, and hazardous materials and waste. Because the additive impacts described in Section 6.1.1 would be less than significant and would not vary by site combination, they are addressed qualitatively by resource area.

Section 6.1.2 addresses additive impacts (from construction and/or operations) that would vary appreciably for different site combinations (and may include some IT/COMM construction impacts). Such impacts apply to the following resource areas: air quality, terrestrial biological resources, cultural resources, and public health and safety. In addition, ground transportation is discussed in this section because traffic impacts would vary depending on the location of the cantonment/family housing and LFTRC alternatives. Section 6.1.2 describes these impacts for the various site combinations, which are grouped in some cases based on geographic proximity, due to the large number of possible site combinations.

6.1.1 Additive IT/COMM Construction Impacts That Do Not Vary by Alternative Combination

6.1.1.1 Geological and Soil Resources

The installation of IT/COMM links between any pair of cantonment/family housing and LFTRC site alternatives would result in direct, short-term impacts to geological and soil resources along the IT/COMM routes. Earthmoving activities would occur mostly within previously-disturbed roadways (the term "roadways" includes road surface plus adjacent shoulders) that do not contain important soil resources. Standard BMPs would be implemented to avoid and minimize typical construction-related impacts (e.g., erosion) and impacts would therefore be less than significant.

6.1.1.2 Water Resources

Construction associated with the IT/COMM lines would result in the potential for short-term increases in stormwater runoff and erosion. The characteristics of the potentially disturbed area would vary somewhat depending on the IT/COMM route (see Table 2.6-1 and Figure 2.6-1 in Chapter 2 for details of the specific routes for each cantonment/LFTRC combination) and, as shown in Table 6.1.1-1, some routes are closer to surface waters and wetlands than others. However, through compliance with the Construction General Permit and Program SWPPP, and implementation of site-specific SWPPPs, and associated erosion control, runoff reduction, and sediment removal BMPs (see Table 4.1.2-2 in Chapter 4 of this SEIS), these effects would be minimized and off-site transport of stormwater runoff would be unlikely,

except during extreme weather events (i.e., typhoons). In addition, roadway-specific BMPs, as identified in the most recent CNMI and Guam Stormwater Management Manual, would be implemented, as applicable. Specifically, the site-specific SWPPPs would identify appropriate BMPs for each route that would contain runoff and sediment on-site (by reducing the flow rate of runoff), thereby minimizing the suspension of sediments and promoting infiltration of runoff. These stormwater runoff protection measures would also serve to both protect surface water, groundwater, and wetlands from indirect impacts, as well as to prevent impacts to nearshore waters.

Table 6.1.1-1. Surface Waters in the Vicinity of IT/COMM Links between Alternatives

Cantonment/Family Housing Alternatives	*LFTRC Alternatives*				
	Route 15 Alternative 1	*NAVMAG (East/West) Alternative 2*	*NAVMAG (North/South) Alternative 3*	*NAVMAG (L-Shaped) Alternative 4*	*NWF Alternative 5*
Number of Surface Waters (Other waters of the U.S. / Wetlands)*					
Alternative A: Finegayan and Alternative B: Finegayan/South Finegayan	6 / 1	21 / 1	18 / 3	21 / 1	6 / 1
Alternative C: AAFB	6 / 1	21 / 1	18 / 3	21 / 1	6 / 1
Alternative D: Barrigada	6 / 1	20 / 1	17 / 3	20 / 1	6 / 1
Alternative E: Finegayan/AAFB	6 / 1	21 / 1	18 / 3	21 / 1	6 / 1

Notes: * The number of wetlands and other waters of the U.S. were tabulated based on the occurrence of a distinct surface water feature within 100 feet (30 m) of the IT/COMM footprint. Any surface water feature occurring outside of this distance would be unlikely to be affected with implementation of construction BMPs.

Because the IT/COMM lines would primarily be located in existing roadways, no direct impacts to wetlands or other waters of the U.S. are anticipated. The potential exposure to direct or indirect impacts at any one location or resource would be short-term, given that construction would not occur simultaneously along the entire IT/COMM route at any one time, and construction at any one location would be of a relatively short duration. Based on these considerations, and given that construction would comply with Construction General Permit requirements and implementation of SWPPPs and BMPs, the proposed construction activities associated with IT/COMM lines would result in less than significant impacts to water resources on any of the routes.

6.1.1.3 Noise

Noise impacts from installation of the IT/COMM lines would only occur in close proximity to the construction activities and would primarily occur along existing roadways that have higher levels of ambient noise from road traffic and other sources. Installation of the IT/COMM lines would be very short-term, lasting only a few days near any given noise receptor before moving along the road easement. Therefore, the impacts would be less than significant.

6.1.1.4 Ground Transportation

Construction of the IT/COMM links between any given combination of cantonment/family housing and LFTRC alternatives would occur primarily along existing roadways, and would potentially include clearing and grubbing, demolition of existing road pavement, excavation, filling, paving, and landscaping. During the construction period in the immediate vicinity of any given construction area along an IT/COMM route, short-term, intermittent impacts to traffic flow would include additional traffic congestion, slower speeds in construction zones, and short detours that may be caused by truck and equipment movements, construction worker vehicles, the delivery of construction materials and equipment, and removal of construction debris. Potential direct and indirect impacts to ground

transportation resources from IT/COMM construction would be minimized with implementation of appropriate work zone traffic management strategies and BMPs. Therefore, the installation of IT/COMM infrastructure along any route would have less than significant direct and indirect short-term impacts to roadways.

6.1.1.5 Hazardous Materials and Waste

Hazardous substances are not anticipated to be widely used or generated for the installation of IT/COMM lines at or between the cantonment, housing, or LFTRC sites. These materials would continue to be managed as described in this SEIS and the 2010 Final EIS (Volume 2, Chapter 17: Table 17.2-3: Summary of BMPs and SOPs, pages 17-42 to 17-43 and Volume 7, Chapter 2: Overview of Best Management Practices and Mitigation Measures, Table 2.1-1, Summary of Key Best Management Practices [Guam and Tinian], pages 2-4 to 2-23). With regard to previously contaminated sites, installation of IT/COMM links would avoid contaminated sites to the maximum extent practicable. If IT/COMM routes were unable to avoid areas where contamination and/or MEC has been identified, a site-specific health and safety plan would be used to ensure that the risk of human exposure to contaminated media is minimized through engineering and administrative controls and appropriate personal protective equipment. In addition, Phase I and II Environmental Site Assessments would be conducted in areas requiring new or additional IT/COMM right-of-way easements prior to construction activities to ensure that project plans consider and address contaminated sites. If installation of IT/COMM links require the demolition or renovation of structures constructed prior to 1978, these structures would be inspected for PCBs, ACM, and LBP. If these materials were identified, licensed contractors would properly remove and dispose of them in accordance with relevant local and federal regulations. Installation of IT/COMM lines would result in less than significant impacts with regard to hazardous materials and waste.

6.1.2 Additive Impacts That Vary by Site Combination

6.1.2.1 Finegayan Cantonment/Family Housing Alternative A or B with Route 15 LFTRC Alternative 1

Air Quality

Finegayan Cantonment/Family Housing Alternative A with Route 15 LFTRC Alternative 1

As discussed in Section 3.3.3.1, this SEIS updated or amended the 2010 Final EIS for the following two analysis elements:

- Hot-spot concentration impacts for mobile source CO, PM, and MSATs under both construction and operation phases.
- Construction phase, island-wide annual emissions for criteria pollutants and CO_2.

As discussed in Sections 3.3.3.1, 4.1.3, and 5.1.3, the on-site and off-site hot-spot analyses were conducted based on the forecasts of location-specific traffic and construction activities under the preferred alternative and the alternative with the likely maximum potential adverse effect. The analysis results indicate that the predicted hot-spot impacts are well below the applicable standards for respective pollutants. Therefore, it can be concluded that the findings shown in Sections 4.1.3 and 5.1.3 would remain the same for each of the combined alternatives and would represent minimal localized hot-spot impacts.

Construction phase, island-wide annual emissions for criteria pollutants and CO_2 would have combined effects from any pair of cantonment/family housing and LFTRC alternatives. The additional combined

island-wide construction emissions are considered in this chapter by combining annual emissions forecasted in Chapters 4 and 5 (see Tables 4.1.3-1 and 5.1.3-1) to determine the potential emissions impact significance using the 250 tpy threshold. Because all of the alternative LFTRC sites are located outside the two SO_2 nonattainment areas, there would be no additive impacts from any of the combined alternatives with respect to the CAA general conformity rule applicability requirement. Therefore, general conformity analysis would not be needed for any of the combined alternatives. Although there would be many IT/COMM line installation options along various routes, the longest route was used to conservatively estimate the emissions associated with IT/COMM line construction activities between 2018 and 2020. These scenarios with the maximum potential adverse effect of IT/COMM construction emissions were then considered for each combined alternative discussed in this Chapter.

The combined construction emissions are summarized in Table 6.1.2-1. Air quality impacts would be less than significant because construction emissions from the combined alternative would be below the significance criterion of 250 tpy for criteria pollutants. As described in Section 3.3, in contrast to criteria pollutants, there are no NAAQS significance thresholds for greenhouse gas emissions, including CO_2. Nevertheless, the predicted greenhouse gas emissions levels for this combined alternative are still presented in Table 6.1.2-1 1 and they are less than those analyzed in the 2010 Final EIS resulting in less GHG impacts as compared to the No-Action Alternative.

Table 6.1.2-1. Finegayan Cantonment/Family Housing (Alternative A) with Route 15 LFTRC (Alternative 1) Annual Construction Emissions (2016-2022)

Construction Year	*Pollutant (tpy)*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOCs*	*CO_2*
2016	neg	neg	neg	neg	neg	neg	neg
2017	0.1	4.0	0.4	0.4	5.6	0.7	801.5
2018	0.5	32.8	2.1	1.9	24.7	4.4	5036.5
2019	0.7	45.7	2.7	2.4	32.2	5.4	7133.1
2020	0.2	18.7	1.1	1.0	11.3	2.6	2507.0
2021	0.8	45.9	2.8	2.5	35.5	4.7	7855.2
2022	0.2	13.6	0.8	0.7	10.5	1.4	2324.4
Significance Threshold	250	250	250	250	250	250	NA

Legend: neg = negligible; NA = not applicable.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with Route 15 LFTRC Alternative 1

The combined air quality impacts for this site combination would be similar to those described above for the combination with Alternative A. Because partial construction activities under this combined alternative would occur within the Tanguisson SO_2 nonattainment area, the CAA general conformity rule would apply to these activities. Based on the predicted annual island-wide combined SO_2 emissions, as shown in Table 6.1.2-2, the annual construction SO_2 emissions within the Tanguisson nonattainment areas would be well below the 100 tpy *de minimis* threshold. Therefore, the formal CAA general conformity rule determination is not required. The combined construction island-wide emissions impacts, summarized in Table 6.1.2-2, would be below the significance criterion of 250 tpy for criteria pollutants, and would therefore be less than significant for this site combination. The CO_2 emissions during the construction period would be less than those analyzed in the 2010 Final EIS resulting in less GHG impacts as compared to the No-Action Alternative.

Table 6.1.2-2. Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with Route 15 LFTRC (Alternative 1) Annual Construction Emissions (2016-2022)

Construction Year	*Pollutant (tpy)*						
	SO_2	CO	PM_{10}	$PM_{2.5}$	NO_x	VOC	CO_2
2016	neg	neg	neg	neg	neg	neg	neg
2017	0.1	4.0	0.4	0.4	5.6	0.7	801.9
2018	0.5	32.8	2.1	1.9	24.8	4.4	5048.6
2019	0.7	45.7	2.7	2.4	32.3	5.4	7155.1
2020	0.2	18.7	1.1	1.0	11.3	2.6	2512.7
2021	0.8	45.9	2.8	2.5	35.6	4.7	7882.8
2022	0.2	13.6	0.8	0.7	10.6	1.4	2332.6
Significance Threshold	250	250	250	250	250	250	NA

Legend: neg = negligible; NA = not applicable.

Terrestrial Biological Resources

Finegayan Cantonment/Family Housing (Alternative A) with Route 15 LFTRC (Alternative 1)

Table 6.1.2-3 combines the direct impacts from Cantonment/Family Housing Alternative A and LFTRC Alternative 1 with the additive impacts from installation of the associated IT/COMM infrastructure. Overall, approximately 1,290 acres (523 ha) of limestone forest would be disturbed, representing approximately 7% of the total limestone forest currently present on Guam. In addition, approximately 1,326 acres (537 ha) of Overlay Refuge lands, or approximately 6% of Overlay Refuge lands on Guam, would be disturbed. The majority (78%) of the impacts to limestone forest would result from implementation of Alternative A (see Section 4.1.8). Approximately 20% of the impacts would result from the implementation of Alternative 1 (see Section 5.1.8), and 2% of impacts would be due to the additive impact of the IT/COMM alignment. Because the IT/COMM route covers many areas across many miles, the area impacted by the proposed IT/COMM activities would generally be made up of smaller areas of limestone forest and would not be one contiguous area. As such, the proposed IT/COMM alignment contributes very little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-3. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan Cantonment/Family Housing (Alternative A), Route 15 LFTRC (Alternative 1), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative A	2 (0.8)	1,005 (407)	1,243 (503)	MFB, MC, GR, GMK, Ser	MS, PSTG	MFB: 957 (387) MC: 957 (387) GR: 500 (202) GMK: 957 (387) Ser: 634 (257)
Alternative 1	65 (26)	190 (77)	NA	GR	-	MFB: 81 (33) MC: 81 (33) GR: 283 (115) GMK: 81 (33) Ser: 67 (27)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**71 (29)**	**1,219 (494)**	**1,326 (537)**	-	-	**MFB: 1,074 (435)** **MC: 1,075 (435)** **GR: 858 (355)** **GMK: 1,074 (435)** **Ser: 731 (296)**

Legend: NA = not applicable, GMK - Guam Micronesian kingfisher, GR - Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with Route 15 LFTRC Alternative 1

Table 6.1.2-4 combines the direct impacts of implementing Cantonment/Housing Alternative B and LFTRC Alternative 1 with the additive impacts from installation of the corresponding IT/COMM infrastructure. Overall, approximately 1,098 acres (444 ha) of limestone forest would be disturbed, representing approximately 6% of the total limestone forest currently present on Guam. The majority (74%) of the impacts to terrestrial biological resources would result from Alternative B, with 815 acres (330 ha) of limestone forest disturbed. In addition, approximately 1,030 acres (417 ha) of Overlay Refuge lands, or less than 5% of Overlay Refuge lands currently present on Guam, would be disturbed. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-4. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan/South Finegayan Cantonment/Family Housing (Alternative B), Route 15 LFTRC (Alternative 1), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative B	2 (0.8)	813 (329)	947 (383)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 754 (305) MC: 754 (305) GR: 571 (231) GMK: 754 (305) Ser: 619 (250)
Alternative 1	65 (26)	190 (77)	NA	GR	-	MFB: 81 (33) MC: 81 (33) GR: 283 (115) GMK: 81 (33) Ser: 67 (27)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**71 (29)**	**1,027 (416)**	**1,030 (417)**	-	-	**MFB: 871 (353)** **MC: 872 (353)** **GR: 991 (401)** **GMK: 871 (353)** **Ser: 716 (290)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, NA = not applicable, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Cultural Resources

Finegayan Cantonment/Family Housing Alternative A with Route 15 LFTRC Alternative 1

Adverse effects to historic properties and impacts to other cultural resources of cultural importance resulting from the implementation of Alternatives A and 5 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. Construction for the IT/COMM lines linking Alternative A and Alternative 1 would occur along Routes 1, 2A, 3, 3A, 4, 4A, 5, 9, 10, 15, and 17. In general, IT/COMM lines would follow existing roads; however; additional lines would be constructed at AAFB and from AAFB to Finegayan. Approximately 43% of these areas have been previously surveyed (Davis 1983; April 1984; Haun 1988; Moore *et al.* 1988; Kurashina *et al.* 1987; Kurashina *et al.* 1988; Amesbury and Moore 1989; Moore and Amesbury 1989; Highness and Haun 1990; Russell and Guerrero 1991; Henry *et al.* 1996, 1999; Hunter-Anderson 1994; Reinman and Nees 1998; Hunter-Anderson and Moore 2002, 2003; Yee *et al.* 2004; DeFant and Guerrero 2006; Church *et al.* 2009; Athens 2009; Dixon *et al.* 2004, 2011a, 2011b, 2015a, 2015b; Olmo *et al.* 2000; Grant *et al.* 2007; Welch 2010; Dixon and Walker 2011; DeFant 2013). As not all of the routes have been surveyed, a literature review of previous surveys and sites located within the construction corridor was undertaken and the likelihood of finding buried cultural resources within PDIA for the IT/COMM lines corridor was assessed based on the level of disturbance, the proximity of known sites, and historic land use (Dixon *et al.* 2014). Within the PDIA for the IT/COMM lines, approximately 0.2% of Route 1, 57% of Route 2A, 100% of Route 3, 54% of Route 3A, 4% of Route 4, 100% of Route 4A, 16% of Route 5, 64% of Route 9, none of Route 10, 59% of Route 15, and 1% of Route 17 have been surveyed.

Table 6.1.2-5 lists 11 known archaeological sites within the IT/COMM lines PDIA. One of the sites, including portions of NWF, is eligible for listing in the NRHP. Ten archaeological sites are not eligible for listing in the NRHP. The literature review indicated that there are also areas that were not previously surveyed that have potential for buried cultural resources along Routes 1, 4, 5, 15, and 17.

Table 6.1.2-5. Archaeological Sites within the IT/COMM Lines Potential Impacted area for Finegayan Cantonment/Family Housing (Alternative A) and Route 15 LFTRC (Alternative 1)

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
	36*	Flagpole	Post-WWII/Second American Territorial	Lauter-Reinman 1997	No	NA
	377*	Ceramic Scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
	1066*	Concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-07-2119	1001*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle dump	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Grant *et al.* 2007	No	NA
66-08-0213	T-16	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
66-08-1065***		Airfield	Post-WWII/Second American Territorial	Aaron *et al.* 2007	Yes	A
	T-A4S-5	Concrete pads	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/Latte / Japanese Military Occupation/Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.
†Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

Notes: *Map Numbers from Welch (2009) and Welch (2010).
**Revised to match Guam GHPI forms dated May 28, 2014.
***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

One structure eligible for listing in the NRHP, North Field, is located within the potential impacted area. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

The installation of IT/COMM links between Alternative A and the LFTRC Alternative 1 has the potential to result in adverse effects from excavation and soil removal to two historic properties, including one NRHP-eligible archaeological site (see Table 6.1.2-5) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be directly affected by the construction of the IT/COMM links.

No direct or indirect adverse effects are anticipated to occur due to operation of the IT/COMM utilities as these lines would be buried and there would be no change in use and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with Route 15 LFTRC Alternative 1

Adverse effects to historic properties under NHPA and impacts to other cultural resources of cultural importance resulting from the implementation of Alternatives A and 5 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. The PDIA for the IT/COMM lines associated with this site combination would be similar to that described above for Alternative A and Alternative 1. The installation of IT/COMM links between Alternative B and the LFTRC Alternative 1 has the potential to cause adverse effects from excavation and soil removal to two historic properties,- including one NRHP-eligible archaeological site (see Table 6.1.2-5) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be directly affected by the construction of the IT/COMM links.

No direct or indirect adverse effects are anticipated to occur due to operation of the IT/COMM utilities as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

Finegayan Cantonment/Family Housing Alternative A with Route 15 LFTRC Alternative 1

The travel demand modeling methodology for the combination of alternatives was defined and directed by the DoD and the FHWA to provide detailed off-base (external) roadway and intersection analysis for one representative pairing (the modeled combination) of each cantonment/family housing alternative with one of the LFTRC site alternatives.

The modeled combination for Cantonment/Family Housing Alternative A included a pairing with LFTRC Alternative 5 (see Section 3.12). Although Alternative 5 was used for the modeled combination, the results allowed for a thorough qualitative assessment of impacts associated with the other cantonment/ family housing and LFTRC alternative combinations as well. Modeling results for this scenario indicate that weekday a.m. peak hour vehicle traffic related to the proposed action is generated solely by operations at the cantonment/family housing area. LFTRC-related traffic would occur prior to the start of weekday a.m. peak hour (8:00 a.m.) and may coincide with the weekday p.m. peak hour (4:30 p.m. to 5:30 p.m.) (see Section 5.1.12). Operations of the LFTRC would increase traffic on the off-base (external) roadway segments and intersections that comprise the most direct route between the main cantonment gate and the LFTRC gates by approximately 38 vehicles (measured in passenger car equivalents) (see Table 5.1.12-2 in Chapter 5). LFTRC-related traffic represents an insubstantial amount of traffic (less than 5%) along the route. This minimal incremental increase in traffic volumes would not adversely affect LOS on roadways or at intersections along the route. The relative contribution from LFTRC traffic to the off-base (external) roadway segment and intersection impacts of each cantonment/family housing alternative would be minimal and would not vary appreciably with any LFTRC pairing (Alternative 1, 2, 3, 4, or 5). Therefore, the impacts to off-base (external) roadway segments and intersections would be essentially the same for Alternative A with Alternative 1, Alternative A with Alternative 2, 3, or 4, and Alternative A with Alternative 5. A qualitative discussion of the potential effects of LFTRC-related traffic is provided for each combination.

Pairing Alternative A with Alternative 1 may result in a slight increase in vehicles (less than 5%) on roadway segments and at intersections that comprise the most direct route between the Alternative A Main Gate and the Alternative 1 gate, and a slight decrease in vehicles compared to the modeled combination Alternative A Main Gate and the Alternative 5 gate (Figure 6.1.2-1). This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route.

The impacts to off-base (external) roadway segments and intersections are summarized in Table 6.1.2-6.

Table 6.1.2-6. Summary of Additive Impacts to Ground Transportation Resources with the Finegayan Cantonment/Family Housing (Alternative A) and any LFTRC Alternative

#	***Roadway Segments****	***Intersections***
1	Route 1, from Route 3 to Route 34 (SI-M)	Route 3 / 9 / Chalan Santa Anita (SI-M)
2	Route 1, from Route 34 to Route 16 (SI-M)	Route 3 / Royal Palm Drive (SI-M)
3	Route 3, from Route 3A/9 to Finegayan Main Gate (SI-M)	Route 1 / Route 3 (SI-M)
4	Route 3, from Finegayan Main Gate To Finegayan Residential Gate (SI-M)	Route 1 / Route 27 (SI-M)
5	Route 3, from Finegayan Residential Gate To Route 28 (SI-M)	Route 1 / Route 26 (SI-M)
6	Route 3, from Route 28 To South Finegayan Main Gate (SI-M)	Route 16 / Route 27 (SI-M)
7	Route 3, from South Finegayan Main Gate To Route 1 (SI-M)	Route 16 / Route 10A (SI-M)
8	Route 28, from Chalan Balako to Route 3 (SI-M)	Route 1 / Route 14A (SI-M)
9	NA	Route 1 / Route 10A (SI-M)
Total	**8, SI-M**	**9, SI-M**

Legend: NA = not applicable, SI-M = significant but may be mitigated impact.
*Notes:**Includes impacts to roadway segments in at least one direction during one (or both) weekday a.m. or p.m. peak hours.

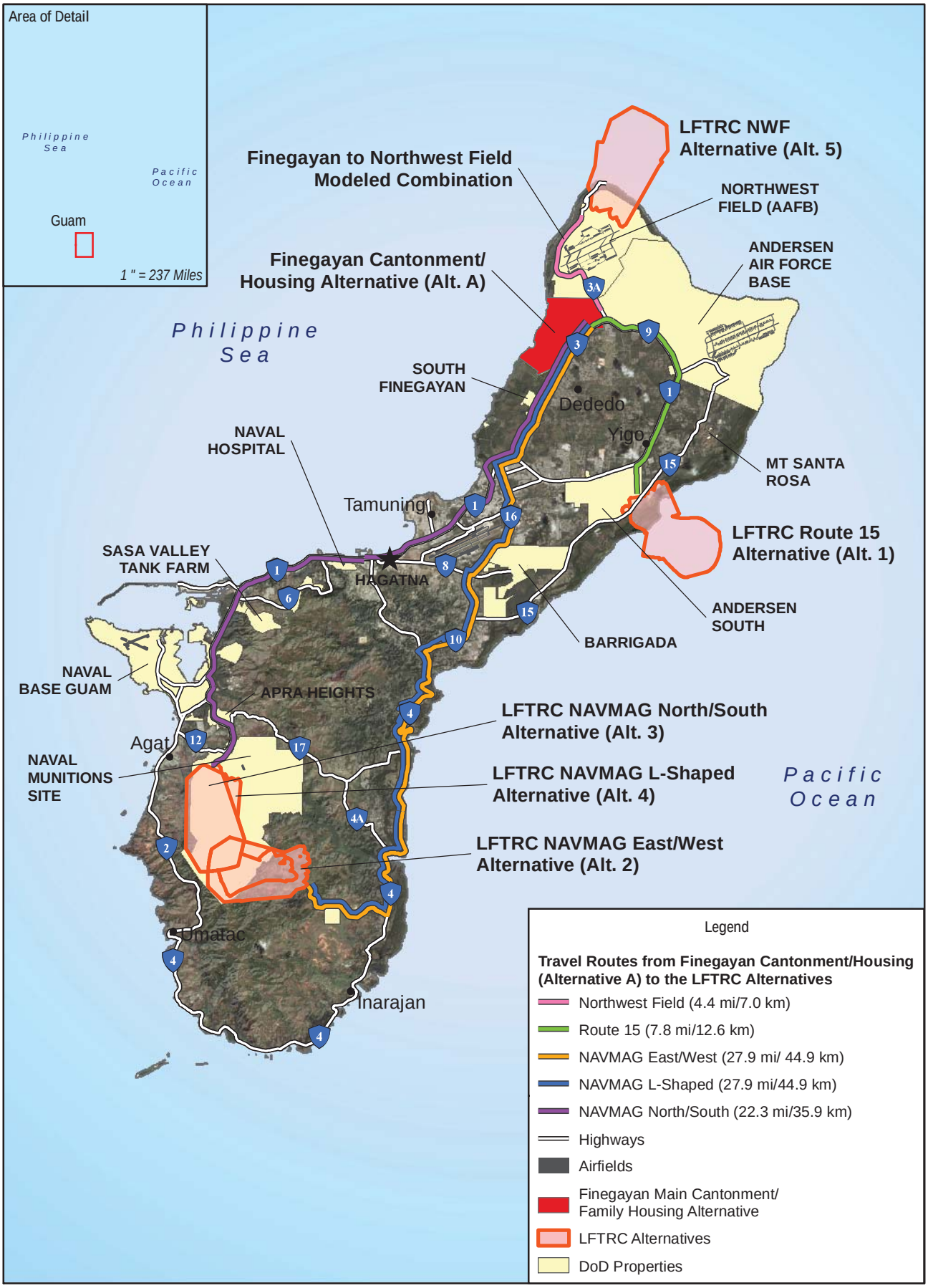


Figure 6.1.2-1
Travel Routes from Finegayan Cantonment/Housing (Alternative A) to the LFTRC Alternatives

Source: NAVFAC Pacific 2013

Roadway Segment Operations. A capacity analysis was conducted to determine potential impacts to the off-base (external) roadway network during weekday a.m. and p.m. peak hours. The volume to capacity (v/c) ratio and LOS for each study roadway segment was compared to the baseline conditions to determine if any significant impacts would occur. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

The addition of traffic generated by the proposed action would result in a potentially significant impact on eight study roadway segments in at least one direction during the weekday a.m. and/or weekday p.m. peak hours:

- Route 1, from Route 3 to Route 34. This study roadway segment currently operates at acceptable LOS E with a v/c ratio of 0.99 in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.01 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative A Conditions, this study roadway segment would continue to operate at LOS F with a v/c ratio of 1.08. The proposed action would increase traffic on this study roadway segment by approximately 180 vehicles during the weekday p.m. peak hour. This 6.9% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday p.m. peak hour.
- Route 1, from Route 34 to Route 16. This study roadway segment currently operates at acceptable LOS E with a v/c ratio of 0.96 in the in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS E with a v/c ratio of 0.97 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative A Conditions, this study roadway segment would degrade to unacceptable LOS F with a v/c ratio of 1.08. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday p.m. peak hour.
- Route 3, from Route 3A/9 to Finegayan Main Gate. This study roadway segment currently operates at acceptable LOS B with a v/c ratio of 0.64 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS C with a v/c ratio of 0.75 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative A Conditions, this study roadway segment would degrade to unacceptable LOS F with a v/c ratio of 1.02. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound during the weekday a.m. peak hour.
- Route 3, from Finegayan Main Gate to Finegayan Residential Gate. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.09 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.24 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative A Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.41. The proposed action would increase traffic on this study roadway segment by approximately 128 vehicles during the weekday p.m. peak hour. This 12.3% increase in traffic exceeds the 5.0% threshold of

significance. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound direction during the weekday a.m. peak hour.

- Route 3, from Finegayan Residential Gate to Route 28. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.23 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at LOS F with a v/c ratio of 1.36 in the southbound/westbound during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative A Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.61. The proposed action would increase the traffic on this study roadway segment by approximately 183 vehicles during the weekday a.m. peak hour. This 15.4% increase in traffic is greater than the 5.0% threshold of significance.
- During the weekday p.m. peak hour, this study roadway segment currently operates at acceptable LOS D with a v/c ratio 0.81 in the northbound/eastbound direction and acceptable LOS B with a v/c ratio of 0.67 and southbound/westbound directions hour under Existing conditions. This study roadway segment would continue to operate at acceptable LOS E with a v/c ratio of 0.91 and LOS C with a v/c ratio of 0.74 in the northbound/eastbound and southbound/westbound directions, respectively, during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative A Conditions, this study roadway segment would degrade to unacceptable LOS F with a v/c ratio of 1.21 in the northbound/eastbound direction and 1.08 in the southbound/westbound direction during the weekday p.m. peak hour. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound directions during the weekday a.m. and p.m. peak hours, and in the northbound/eastbound direction during the weekday p.m. peak hour.
- Route 3, from Route 28 to South Finegayan Main Gate. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.07 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.25 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative A Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.36. The proposed action would increase traffic on this study roadway segment by approximately 165 vehicles during the weekday p.m. peak hour. This 7.7% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the southbound/westbound direction on this study roadway segment during the weekday a.m. peak hour.
- Route 3, from South Finegayan Main Gate to Route 1. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 2.11 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. Construction of roadway improvements (i.e., signalization of the intersections at Guam Regional Medical City and Okkodo High School and provision of an additional southbound through lane on Route 3) would increase the capacity of this roadway segment. However, despite the fact that these improvements would be constructed prior to Year 2030, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.35 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative A Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.45. The proposed action would increase traffic on this study roadway segment by approximately 161 vehicles during the weekday a.m. peak hour. This 7.0% increase in traffic

exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the southbound/westbound direction on this study roadway segment during the weekday a.m. peak hour.

- Route 28, from Chalan Balako to Route 3. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.08 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would continue to operate at LOS F with a v/c ratio of 1.48 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative A Conditions, this study roadway segment would continue to operate at LOS F with a v/c ratio of 1.56 in the southbound/westbound direction during the weekday a.m. peak hour. The proposed action would increase the traffic on this study roadway segment by approximately 54 vehicles during the weekday a.m. peak hour. This 5.1% increase in traffic is greater than the 5.0% threshold of significance.
- During the weekday p.m. peak hour, this study roadway segment currently operates at acceptable LOS B with a v/c ratio of 0.68 in the northbound/eastbound direction under Existing Conditions. This study roadway segment would operate at acceptable LOS E in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative A Conditions, this study roadway segment would degrade to operate at unacceptable LOS F with a v/c ratio of 1.04 in the northbound/eastbound direction during the weekday p.m. peak hour. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound direction during the weekday a.m. peak hour and in the northbound/eastbound direction during the weekday p.m. peak hour.

To reduce impacts to less than significant levels on these study roadway segments, the following potential mitigation measures may be implemented:

- Potential Mitigation Measure Fin-Roads-1: Provide additional eastbound travel lane. Widening of the segment of Route 1, from Route 3 to Route 34, a distance of approximately 0.5 mile (1.0 km) would be required to provide one additional travel lane in the eastbound direction. With implementation of Potential Mitigation Measure Fin-Roads-1, LOS on this study roadway segment would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
  While the significant impact could be mitigated with the addition of an eastbound travel lane, GDPW may wish to consider adding a westbound travel lane to increase capacity and improve traffic flow in both directions along Route 1.
- Potential Mitigation Measure Fin-Roads-2: Provide additional eastbound travel lane. Widening of the segment of Route 1, from Route 34 to Route 16, a distance of approximately 0.06 mile (0.10 km), would be required to provide one additional travel lane in the eastbound direction. With implementation of Potential Mitigation Measure Fin-Roads-2, LOS on this study roadway segment would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-Roads-3: Provide additional southbound travel lane. Widening of the segment of Route 3, from Route 3A/9 to Finegayan Main Gate, a distance of approximately 0.5 mile (0.8 km), would be required to provide one additional travel lane in the southbound direction. With implementation of Potential Mitigation Measure Fin-Roads-3, LOS on this study roadway segment would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)

- Potential Mitigation Measure Fin-Roads-4: Provide additional southbound travel lane. Widening of the segment of Route 3, from Finegayan Main Gate to Finegayan Residential Gate, a distance of approximately 1.75 miles (2.82 km), would be required to provide one additional travel lane in the southbound direction. With implementation of Potential Mitigation Measure Fin-Roads-4, LOS on this study roadway segment would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-Roads-5: Provide additional travel lanes in the northbound and southbound directions. Widening of the segment of Route 3, from Finegayan Residential Gate to Route 28, a distance of approximately 0.5 mile (0.8 km), would be required to provide one additional travel lane in the northbound and southbound directions. With implementation of Potential Mitigation Measure Fin-Roads-5, LOS on this study roadway segment would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-Roads-6: Provide additional southbound travel lane. Widening of the segment of Route 3, from Route 28 to South Finegayan Main Gate, a distance of approximately 0.87 mile (1.40 km), would be required to provide one additional travel lane in the southbound direction. With implementation of Potential Mitigation Measure Fin-Roads-6, LOS on this study roadway segment would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-Roads-7: Provide additional southbound travel lane. Widening of the segment of Route 3, from South Finegayan Main Gate to Route 1, a distance of approximately 1.67 miles (2.68 km), would be required to provide one additional travel lane in the southbound direction. With implementation of Potential Mitigation Measure Fin-Roads-7, LOS on this study roadway segment would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-Roads-8: Provide additional eastbound and westbound travel lanes. Widening of the segment of Route 28, from Chalan Balako to Route 3, a distance of approximately 0.97 mile (1.56 km), would be required to provide one additional travel lane in the eastbound and westbound directions. With implementation of Potential Mitigation Measure Fin-Roads-8, LOS on this study roadway segment would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)

The measures needed to mitigate the impacted roadway segments would be feasible at all eight locations. The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Intersection Operations. Intersection analysis was conducted to determine potential impacts to the off-base (external) intersections during weekday a.m. and p.m. peak hours. The LOS for each study intersection was compared to the baseline conditions to determine if any significant impacts would occur. An impact summary is provided in Table 6.1.2-6. The detailed results of the intersection analysis are provided in their entirety in Appendix F.

The addition of traffic generated by the proposed action would potentially result in a significant impact at nine study intersections during the weekday a.m. and/or weekday p.m. peak hours.

- Route 3 / 9 / Chalan Santa Anita. This two-way stop-controlled study intersection currently operates at acceptable LOS C with 21.9 seconds of delay and would continue to operate at acceptable LOS E with 37.7 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative A Conditions, this study intersection would degrade to unacceptable LOS F with greater than 180.0 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour.
- Route 3 / Royal Palm Drive. This two-way stop-controlled study intersection currently operates at acceptable LOS C with 16.3 seconds of delay and would operate at acceptable LOS E with 36.4 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative A Conditions, this study intersection would degrade to unacceptable LOS F with 54.1 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour.
- Route 1 / Route 3. This signalized study intersection currently operates at LOS F and would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. During the weekday p.m. peak hour this study intersection currently operates at LOS E with 70.8 seconds of delay and would continue to operate at LOS E with 63.4 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative A Conditions, this study intersection would continue to operate at LOS F with greater than 180.0 seconds of delay and the proposed action would add more than 50 vehicles to this poorly performing intersection during the weekday a.m. peak hour. During the weekday p.m. peak hour the intersection would degrade to operate at unacceptable LOS F with 83.0 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours.
- Route 1 / Route 27. This signalized study intersection currently operates at acceptable LOS E with 70.3 seconds of delay and would operate at unacceptable LOS F with 118.3 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative A Conditions, this study intersection would continue to operate at unacceptable LOS F with 121.6 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour.
- Route 1 / Route 26. This signalized study intersection currently operates at acceptable LOS C with 27.9 seconds of delay and would operate at unacceptable LOS F with 87.6 seconds of delay during the weekday p.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative A Conditions, this study intersection would continue to operate at unacceptable LOS F with 91.9 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour.

- Route 16 / Route 27. This signalized study intersection currently operates at acceptable LOS D with 50.1 seconds of delay and acceptable LOS E with 71.2 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This signalized study intersection would operate at unacceptable LOS F with greater than 180.0 seconds of delay and 154.7 seconds of delay during the weekday a.m. and p.m. peak hours, respectively under Year 2030 Baseline Conditions. Under Year 2030 Alternative A Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay and 160.9 seconds of delay during the weekday a.m. and p.m. peak hours, respectively. The project would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours.
- Route 16 / Route 10A. This signalized study intersection currently operates at unacceptable LOS F and would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative A Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay. The project would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour.
- Route 1 / Route 14A. This signalized study intersection currently operates at unacceptable LOS F with 156.1 seconds of delay during the weekday p.m. peak hour under Existing Conditions. This study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday p.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative A Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour.
- Route 1 / Route 10A. This signalized study intersection currently operates at acceptable LOS E with 62.6 seconds of delay and would operate at unacceptable LOS F with 139.3 seconds of delay during the weekday p.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative A Conditions, this study intersection would continue to operate at unacceptable LOS F with 144.7 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour.

To reduce impacts to less than significant levels on these study intersections, the following potential mitigation measures may be implemented:

- Potential Mitigation Measure Fin-Int-1: Combine Route 3, 3A and 9 into one signalized intersection. Combine Route 3, 3A and 9 into one signalized intersection with the following configuration:
  - Northbound (Chalan Santa Anita): one left turn lane with 150-foot (46-m) storage pocket, one shared through/right-turn lane.
  - Southbound (Route 3A): One left turn lane with 200-foot (61-m) storage pocket and one shared through/right-turn lane.

- Eastbound (Route 3) and westbound (Route 8): one left-turn lane with 200-foot (61-m) storage pocket, one through lane, and one shared through/right-turn lane.

With implementation of Potential Mitigation Measure Fin-Int-1, LOS at this study intersection would improve and the significant impact would be mitigated to less than significant levels. The new combined intersection would operate at LOS C (21.6 seconds of delay) and LOS B (13.2 seconds of delay) during the weekday a.m. and p.m. peak hours, respectively. Therefore, this impact is considered to be significant but mitigable. (SI-M)

- Potential Mitigation Measure Fin-Int-2: Add exclusive eastbound right-turn lane on Royal Palm Drive. Provide an exclusive eastbound right-turn lane on Royal Palm Drive with 100-foot (30-m) storage pocket. With implementation of Potential Mitigation Measure Fin-Int-2, LOS at this study intersection would improve and the significant impact would be mitigated to less than significant levels. The Route 3/Royal Palm Drive two-way stop-controlled intersection would operate at LOS E (45.4 seconds of delay) and LOS C (15.7 seconds of delay) during the weekday a.m. and p.m. peak hours, respectively. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-Int-3: Add second eastbound left-turn lane and exclusive westbound right-turn lane on Route 1. Provide a second eastbound left-turn lane and an exclusive westbound right-turn lane with 200-foot (61-m) storage pocket on Route 1. Provide an acceleration lane on westbound Route 1 for southbound right-turning vehicles from Route 3. Relocate the pedestrian crossing to the east leg of the intersection. Coordinate signal with the new signal on Route 3 being constructed as part of the Guam Regional Medical City hospital. With implementation of Potential Mitigation Measure Fin-Int-3, operations at this signalized intersection would improve and the significant impact would be mitigated to less than significant levels. The Route 1/Route 3 signalized intersection would operate at LOS F (118.8 seconds of delay) and LOS B (15.5 seconds of delay) during the weekday a.m. and p.m. peak hours, respectively. Although the intersection would continue to operate at LOS F during the weekday a.m. peak hour, average intersection delay under Year 2030 Alternative A with LFTRC at NWF (Alternative 5) Conditions would be less than the average intersection delay under Year 2030 Baseline Conditions. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-Int-4: Restripe southbound (Salisbury Street) approach and provide northbound right-turn overlap phase on Route 27. Restripe the southbound (Salisbury Street) approach to one left-turn lane with 80 feet (24 m) storage length, one through lane and one right-turn lane with 50 feet (15 m) storage length. Provide a right-turn overlap phase on the northbound (Route 27) approach. With implementation of Potential Mitigation Measure Fin-Int-4, LOS at this signalized intersection would improve and the significant impact would be mitigated to less than significant levels. The Route 1/Route 27 signalized intersection would improve to operate at LOS F (97.3 seconds of delay) and LOS D (44.1 seconds of delay) and LOS D (38.8 seconds of delay) during the weekday a.m. and p.m. peak hours, respectively. Although the intersection would continue to operate at LOS F during the weekday a.m. peak hour, average intersection delay under Year 2030 Alternative A with LFTRC Alternative 5 Conditions would be less than the average intersection delay under Year 2030 Baseline Conditions. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-Int-5: Provide northbound right-turn overlap phase on Route 26. Provide a right-turn overlap phase on the northbound (Route 26) approach. With implementation of Potential Mitigation Measure Fin-Int-5, LOS at this signalized intersection would improve and the significant impact would be mitigated to less than significant levels. The

Route 1/Route 26 signalized intersection would operate at LOS D (35.2 seconds of delay) and LOS E (64.2 seconds of delay) during the weekday a.m. and p.m. peak hours, respectively. Therefore, this impact is considered to be significant but mitigable. (SI-M)

- Potential Mitigation Measure Fin-Int-6: Convert westbound right-turn lane to through lane and provide exclusive westbound and eastbound right-turn lanes on Route 27. Widen and reconfigure the westbound (Route 27) approach. Convert the existing right-turn lane to a westbound (Route 27) through lane and add an exclusive westbound (Route 27) right-turn lane with 150 feet (46 m) storage length. Provide an exclusive eastbound (Route 27) right-turn lane with 150 feet (46 m) storage length. With implementation of Potential Mitigation Measure Fin-Int-8, LOS at this signalized intersection would improve and the significant impact would be mitigated to less than significant levels. The Route 16/Route 27 signalized intersection would operate at LOS F (117.1 seconds of delay) and LOS F (91.5 seconds of delay) during the weekday a.m. and p.m. peak hours, respectively. Although the intersection would continue to operate at LOS F during the weekday a.m. and p.m. peak hours, average intersection delay under Year 2030 Alternative A with LFTRC Alternative 5 Conditions would be less than the average intersection delay under Year 2030 Baseline Conditions. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-Int-7: Provide free southbound right-turn on Route 16. Provide a free right-turn on the southbound (Route 16) approach. With implementation of Potential Mitigation Measure Fin-Int-7, operations at intersection would improve and the significant impact would be mitigated to less than significant levels. The Route 16/Route 10A signalized intersection would operate at acceptable LOS E (55.4 seconds of delay) and LOS D (52.2 seconds of delay) during the weekday a.m. and p.m. peak hours, respectively. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-Int-8: Provide exclusive eastbound right-turn lane on Route 1. Widen and reconfigure the eastbound (Route 1) approach. Provide an exclusive eastbound (Route 1) right-turn lane with 150 feet (46 m) storage length. With implementation of Potential Mitigation Measure Fin-Int-8, operations at this signalized intersection would improve and the significant impact would be mitigated to less than significant levels. The Route 1/Route 14A signalized intersection would operate at acceptable LOS D (37.4 seconds of delay) and LOS F (161.9 seconds of delay) during the weekday a.m. and p.m. peak hours, respectively. Although the intersection would continue to operate at LOS F during the weekday p.m. peak hour, average intersection delay under Year 2030 Alternative A with LFTRC Alternative 5 Conditions would be less than the average intersection delay under Year 2030 Baseline Conditions. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-Int-9: Provide a free northbound right-turn lane on Route 1. Provide a free right-turn on the northbound (Route 1) approach. With implementation of Potential Mitigation Measure Fin-Int-9, LOS at this intersection would improve and the significant impact would be mitigated to less than significant levels. The Route 1/Route 10A signalized intersection would operate at acceptable LOS D (38.4 seconds of delay) and acceptable LOS E (69.1 seconds of delay) during the weekday a.m. and p.m. peak hours, respectively. Therefore, this impact is considered to be significant but mitigable. (SI-M)

The measures needed to mitigate the impacted intersections would be feasible at all nine locations. The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies, to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Transit Conditions. While none of the proposed cantonment/family housing or LFTRC alternatives are directly served by fixed-route transit, the proposed action may have a minor impact on the operation of Grey Line #1 by increasing travel delay at the Route 1/Route 3 intersection and the Route 1/Route 26 intersection during the weekday a.m. and p.m. peak hours. However, the increase in travel time would not be substantial and would not be expected to negatively effect on-time performance (e.g., substantially increase transit headways or reduce frequency). Additionally, implementation of Potential Mitigation Measure Fin-Int-3 and Potential Mitigation Measure Fin-Int-5 would improve operations and reduce average delay at these locations compared to Year 2030 Baseline Conditions.

Pedestrian and Bicycle Conditions. The proposed action would result in a significant increase in vehicular traffic on Route 3, whose northern portions near the main cantonment lack shoulders or sidewalks. This increases the potential for collisions with bicyclists and pedestrians at the locations where they are likely to be present. Specifically, Artero Drive (Finegayan Elementary School and McDonald's) and Okkodo High School. The design requirements for the proposed action, include provision of pedestrian and bicycle facilities to be consistent with the 2030 Guam Transportation Plan. Based on recommendations and requirements included in the 2030 Guam Transportation Plan, the following pedestrian and bicycle improvements will be constructed:

- Where feasible, the outside through lanes on Route 1 should be widened to a minimum of 14.0-feet (4.2-m) to accommodate bicycle travel.
- Where feasible, 4.0-foot (1.2-m) wide shoulders should be provided on Route 3 to accommodate pedestrians and bicyclists.

Implementation of these improvements would reduce potential impacts to less than significant levels.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with Route 15 LFTRC Alternative 1

The travel demand modeling methodology for the combination of alternatives was defined and directed by the DoD and the FHWA to provide detailed off-base (external) roadway and intersection analysis for one representative pairing (the modeled combination) of each cantonment/family housing alternative with one of the LFTRC site alternatives. The modeled combination for Alternative B involved a pairing with LFTRC Alternative 2 or 4 (see Section 3.12 in Chapter 3). Modeling results for this scenario indicate that weekday a.m. peak hour vehicle traffic related to the proposed action is generated solely by operations at the cantonment/family housing area. LFTRC-related traffic would occur prior to the start of weekday a.m. peak hour (8:00 a.m.) and may coincide with the weekday p.m. peak hour (4:30 p.m. to 5:30 p.m.) (see Section 5.1.12 in Chapter 5). Operations of the LFTRC would increase traffic on the off-base (external) roadway segments and intersections that comprise the most direct route between the main cantonment gate and the LFTRC gates, by approximately 38 vehicles (measured in passenger car equivalents) (see Table 5.1.12-2). LFTRC-related traffic represents an insubstantial amount of traffic (less than 5%) along the route. This minimal incremental increase in traffic volumes would not adversely affect LOS on roadways or at intersections along the route. The relative contribution from LFTRC traffic to the off-base (external) roadway segments and intersections of each cantonment/family housing alternative would be minimal and would not vary appreciably with any LFTRC pairing (Alternative 1, 2, 3, 4, or 5). Therefore,

the impacts to off-base (external) roadway segments and intersections would be essentially the same for Alternative B with Alternative 1, Alternative B with Alternative 2, 3, or 4, and Alternative B with Alternative 5. A qualitative discussion of the potential effects of LFTRC-related traffic is provided for each combination.

Pairing Alternative B with Alternative 1 may result in a slight increase (less than 5%) in vehicles on roadway segments and at intersections along the most direct route between the Alternative B Main Gate and the Alternative 1 gate, and a slight decrease in vehicles compared to the modeled combination of Alternative B Main Gate and the Alternative 2 or 4 gate (Figure 6.1.2-2). This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route.

The impacts to off-base (external) roadway segments and intersections are summarized in Table 6.1.2-7.

Table 6.1.2-7. Summary of Additive Impacts to Ground Transportation Resources with the Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with any LFTRC

#	*Roadway Segments**	*Intersections*
1	Route 1, from Route 3 to Route 34 (SI-M)	Route 3 / 9 / Chalan Santa Anita (SI-M)
2	Route 1, from Route 34 to Route 16 (SI-M)	Route 3 / Royal Palm Drive (SI-M)
3	Route 3, from Route 3A/9 to Finegayan Main Gate (SI-M)	Route 15 / Chalan Lajuna (SI)**
4	Route 3, from Finegayan Main Gate To Finegayan Residential Gate (SI-M)	Route 1 / Route 3 (SI-M)
5	Route 3, from Finegayan Residential Gate To Route 28 (SI-M)	Route 1 / Route 27 (SI-M)
6	Route 3, from Route 28 To South Finegayan Main Gate (SI-M)	Route 1 / Route 26 (SI-M)
7	Route 3, from South Finegayan Main Gate To Route 1 (SI-M)	Route 16 / Route 27 (SI-M)
8	Route 16, from Route 27 to Route 10A (SI)**	Route 16 / Route 10A (SI-M)
9	Route 28, from Chalan Balako to Route 3 (SI-M)	Route 15 / Route 26 (SI)**
10	Route 16, from Route 10A To Barrigada Main Gate (SI)**	Route 1 / Route 14A (SI-M)
11	NA	Route 1 / Route 10A (SI-M)
Total	**10 (2 SI, 8 SI-M)**	**11 (2 SI, 9 SI-M)**

Legend: NA+ not applicable. SI indicates significant impact. SI-M indicates significant but may be mitigated impact.
Notes: * Includes impacts to roadway segments in at least one direction during one (or both) weekday a.m. or p.m. peak hours.
** Indicates an impact that would not occur under Year 2030 Alternative A Conditions.

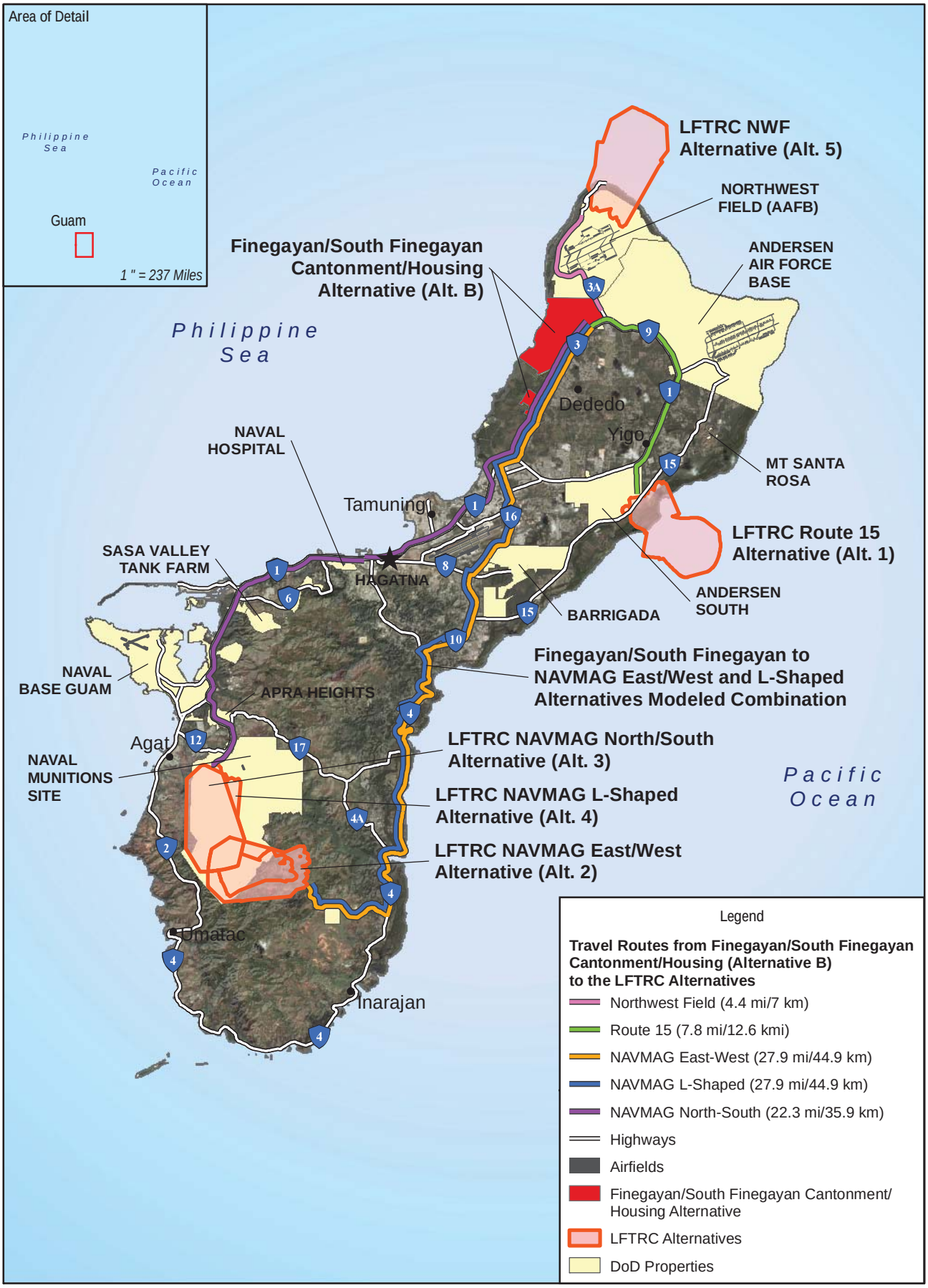


Figure 6.1.2-2
Travel Routes from Finegayan/South Finegayan Cantonment/ Housing (Alternative B) to the LFTRC Alternatives

Source: NAVFAC Pacific 2013

Roadway Segment Operations. A capacity analysis was conducted to determine potential impacts to the off-base (external) roadway network during weekday a.m. and p.m. peak hours. The LOS for each study roadway segment was compared to the baseline conditions to determine if any significant impacts would occur. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

The addition of traffic generated by the proposed action would potentially result in a significant impact on ten study roadway segments in at least one direction during the weekday a.m. and/or weekday p.m. peak hours.

- Route 1, from Route 3 to Route 34. This study roadway segment currently operates at LOS E with a v/c ratio of 0.99 in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at LOS F with a v/c ratio of 1.01 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study roadway segment would continue to operate at LOS F with a v/c ratio of 1.11. The proposed action would increase traffic on this study roadway segment by approximately 250 vehicles during the weekday p.m. peak hour. This 9.3% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday p.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.
- Route 1, from Route 34 to Route 16. This study roadway segment currently operates at acceptable LOS E with a v/c ratio of 0.96 in the in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS E with a v/c ratio of 0.97 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study roadway segment would degrade to unacceptable LOS F with a v/c ratio of 1.07. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday p.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.
- Route 3, from Route 3A/9 to Finegayan Main Gate. This study roadway segment currently operates at acceptable LOS B with a v/c ratio of 0.64 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS C with a v/c ratio of 0.75 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study roadway segment would degrade to unacceptable LOS F with a v/c ratio of 1.07 during the weekday a.m. peak hour. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound during the weekday a.m. peak hour. A similar impact was identified on this study roadway segment during the weekday a.m. peak hour under Year 2030 Alternative A Conditions. An impact was not identified during the weekday p.m. peak hour Year 2030 Alternative A Conditions.
- Route 3, from Finegayan Main Gate to Finegayan Residential Gate. This study roadway segment currently operates at acceptable LOS A with a v/c ratio of 0.45 and 0.60 in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours, respectively under Existing Conditions. This study roadway segment would continue to operate at acceptable LOS A with a v/c ratio of 0.49 during the weekday a.m. peak hour and would operate at acceptable LOS B with a v/c ratio of 0.68 during the weekday a.m. and p.m. peak hours, respectively, in the

northbound/eastbound direction under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this roadway segment would degrade to operate at unacceptable LOS F with a v/c ratio of 1.17 and 1.10 during the weekday a.m. and p.m. peak hours, respectively.

This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.09 and acceptable LOS A with a v/c ratio of 0.51 in the southbound/westbound direction during the weekday a.m. and p.m. peak hours, respectively under Existing Conditions. This study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.24 in the during the weekday a.m. peak hour, and at acceptable LOS A with a v/c ratio of 0.56 in the southbound/westbound direction during the weekday a.m. and p.m. peak hours, respectively, under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.44 and would degrade to operate at LOS F with a v/c ratio of 1.14 in the southbound/westbound direction during the weekday a.m. and p.m. peak hours, respectively. The proposed action would increase traffic on this study roadway segment by approximately 151 vehicles during the weekday a.m. peak hour. This 14.1% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact on this study roadway segment in the northbound/eastbound and southbound/westbound directions during the weekday a.m. and p.m. peak hours.

A similar impact was identified in the southbound/westbound direction on this study roadway segment during the weekday a.m. peak hour under Year 2030 Alternative A Conditions. An impact was not identified in the northbound/eastbound direction during either the weekday a.m. or p.m. peak hours, nor in the southbound/westbound direction during the weekday p.m. peak hour under Year 2030 Alternative A Conditions.

- Route 3, from Finegayan Residential Gate to Route 28. This study roadway segment currently operates at acceptable LOS B with a v/c ratio of 0.67 and LOS D with a v/c ratio of 0.81 in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours, respectively under Existing Conditions. This study roadway segment would operate at acceptable LOS B with a v/c ratio of 0.70 and LOS E with a v/c ratio of 0.90 in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours, respectively, in the northbound/eastbound direction under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this roadway segment would degrade to operate at unacceptable LOS F with a v/c ratio of 1.41 and 1.29 during the weekday a.m. and p.m. peak hours, respectively.

  This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.23 and acceptable LOS B with a v/c ratio of 0.67 in the southbound/westbound direction during the weekday a.m. and p.m. peak hours, respectively under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.36 during the weekday a.m. peak hour, and at acceptable LOS C with a v/c ratio of 0.74 during the weekday p.m. peak hour in the southbound/westbound direction under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.55 and would degrade to operate at LOS F with a v/c ratio of 1.44 in the southbound/westbound direction during the weekday a.m. and p.m. peak hours, respectively. The proposed action would increase traffic on this study roadway segment by approximately 143 vehicles during the weekday p.m. peak hour. This 12.5% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact on

this study roadway segment in the northbound/eastbound and southbound/westbound directions during the weekday a.m. and p.m. peak hours.

A similar impact was identified in the southbound/westbound direction on this study roadway segment during the weekday a.m. peak hour under Year 2030 Alternative A Conditions. An impact was not identified in the northbound/eastbound direction during either the weekday a.m. or p.m. peak hours, nor in the southbound/westbound direction during the weekday p.m. peak hour under Year 2030 Alternative A Conditions.

- Route 3, from Route 28 to South Finegayan Main Gate. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.07 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.25 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.36 in the southbound/westbound direction. The proposed action would increase traffic on this study roadway segment by approximately 166 vehicles during the weekday p.m. peak hour. This 7.7% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the southbound/westbound direction on this study roadway segment during the weekday a.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.
- Route 3, from South Finegayan Main Gate to Route 1. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 2.11 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. Construction of roadway improvements (i.e., signalization of the intersections at Guam Regional Medical City and Okkodo High School and provision of an additional southbound through lane on Route 3) would increase the capacity of this roadway segment. However, despite the fact that these improvements would be constructed prior to Year 2030, this study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.35 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.46. The proposed action would increase traffic on this study roadway segment by approximately 168 vehicles during the weekday a.m. peak hour. This 7.3% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the southbound/westbound direction on this study roadway segment during the weekday a.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.
- Route 16, from Route 27 to Route 10A. This study roadway segment currently operates at acceptable LOS D with a v/c ratio of 0.84 in the northbound/eastbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS E with a v/c ratio of 0.98 in the northbound/eastbound during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study roadway segment would degrade to LOS F with a v/c ratio of 1.01. Therefore, the proposed action would result in a significant impact on this study roadway segment in the northbound/eastbound direction during the weekday p.m. peak hour. No impacts were identified on this study roadway segment under Year 2030 Alternative A Conditions.

- Route 28, from Chalan Balako to Route 3. This study roadway segment currently operates at acceptable LOS D with a v/c ratio of 0.87 in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS E with a v/c ratio of 0.98 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study roadway segment would degrade to LOS F with a v/c ratio of 1.01. Therefore, the proposed action would result in a significant impact on this study roadway segment in the northbound/eastbound direction during the weekday p.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions. An additional impact in the southbound/westbound direction was identified during the weekday a.m. peak hour under Year 2030 Alternative A Conditions.
- Route 16, from Route 10A to Barrigada Main Gate. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.09 in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.05 in the northbound/eastbound during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study roadway segment would continue to operate at LOS F with a v/c ratio of 1.11. The proposed action would increase traffic on this study roadway segment by approximately 94 vehicles during the weekday a.m. peak hour. This 5.3% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday p.m. peak hour. No impacts were identified on this study roadway segment under Year 2030 Alternative A Conditions.

To reduce impacts to less than significant levels on these study roadway segments, the following potential mitigation measures may be implemented:

- Potential Mitigation Measure Fin-S. Fin-Roads-1: Implement Potential Mitigation Measure Fin-Roads-1. With implementation of Potential Mitigation Measure Fin-Roads-1, traffic operations on Route 1, from Route 3 to Route 34 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Roads-2: Implement Potential Mitigation Measure Fin-Roads-2. With implementation of Potential Mitigation Measure Fin-Roads-2, traffic operations on Route 1, from Route 34 to Route 16 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Roads-3: Implement Potential Mitigation Measure Fin-Roads-3. With implementation of Potential Mitigation Measure Fin-Roads-3, traffic operations on Route 3, from Route 3A/9 to Finegayan Main Gate would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Roads-4: Implement Potential Mitigation Measure Fin-Roads-4. With implementation of Potential Mitigation Measure Fin-Roads-4, traffic operations on Route 3, from Finegayan Main Gate to Finegayan Residential Gate would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)

- Potential Mitigation Measure Fin-S. Fin-Roads-5: Implement Potential Mitigation Measure Fin-Roads-5. With implementation of Potential Mitigation Measure Fin-Roads-5, traffic operations on Route 3, from Finegayan Residential Gate to Route 28 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Roads-6: Implement Potential Mitigation Measure Fin-Roads-6. With implementation of Potential Mitigation Measure Fin-Roads-6, traffic operations on Route 3, from Route 28 to South Finegayan Main Gate would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Roads-7: Implement Potential Mitigation Measure Fin-Roads-7. With implementation of Potential Mitigation Measure Fin-Roads-7, traffic operations on Route 3, from South Finegayan Main Gate to Route 1 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Roads-8: Implement Potential Mitigation Measure Fin-Roads-8. With implementation of Potential Mitigation Measure Fin-Roads-8, traffic operations on Route 28, from Chalan Balako to Route 3 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)

Significant impacts would also occur at two locations and potential mitigation measures have not been identified:

- Route 16, from Route 27 to Route 10A (SI)
- Route 16, from Route 10A to Barrigada Main Gate (SI)

The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies, to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Intersection Operations. Intersection analysis was conducted to determine potential impacts to the off-base (external) intersections during weekday a.m. and p.m. peak hours. The LOS for each study intersection is compared to the baseline conditions to determine if any significant impacts would occur. An impact summary is provided in Table 6.1.2-7. The detailed results of the intersection analysis are provided in their entirety in Appendix F.

The addition of traffic generated by the proposed action would potentially result in a significant impact at 11 study intersections during the weekday a.m. and/or weekday p.m. peak hours.

- Route 3 / 9 / Chalan Santa Anita. This two-way stop-controlled study intersection currently operates at acceptable LOS C with 21.9 seconds of delay and would operate at acceptable LOS E with 37.7 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative B Conditions, this study intersection would degrade to unacceptable LOS F with greater than 180.0 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour. A similar impact was identified under Year 2030 Alternative A Conditions.

- Route 3 / Royal Palm Drive. This two-way stop-controlled study intersection currently operates at acceptable LOS C with 16.3 seconds of delay and would operate at acceptable LOS E with 36.4 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative B Conditions, this study intersection would degrade to unacceptable LOS F with greater than 180.0 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour. A similar impact was identified under Year 2030 Alternative A Conditions.
- Route 15 / Chalan Lajuna. This two-way stop-controlled study intersection currently operates at LOS D with 30.7 seconds of delay and LOS C with 23.9 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This study intersection would operate at unacceptable LOS F with 75.8 seconds of delay and 82.6 seconds of delay during the weekday a.m. and p.m. peak hours under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative B Conditions, this study intersection would continue to operate at LOS F with 98.0 seconds of delay and 96.1 seconds of delay during the weekday a.m. and p.m. peak hours, respectively. The proposed action would not add more than 50 vehicles to this poorly performing intersection during the weekday a.m. peak hour. However, the proposed action would add more than 50 vehicles to this poorly performing intersection during the weekday p.m. peak hour. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour. No impacts were identified at this study intersection under Year 2030 Alternative A Conditions.
- Route 1 / Route 3. This signalized study intersection currently operates at LOS F and would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. During the weekday p.m. peak hour this study intersection currently operates at LOS E with 70.8 seconds of delay and would continue to operate at acceptable LOS E with 63.4 seconds of delay under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative B Conditions, this study intersection would continue to operate at LOS F with greater than 180.0 seconds of delay and the proposed action would add more than 50 vehicles to this poorly performing intersection during the weekday a.m. peak hour. During the weekday p.m. peak hour the intersection would degrade to operate at unacceptable LOS F with 99.8 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours. A similar impact was identified under Year 2030 Alternative A Conditions.
- Route 1 / Route 27. This signalized study intersection currently operates at acceptable LOS E with 70.3 seconds of delay and would operate at unacceptable LOS F with 118.3 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative A Conditions, this study intersection would continue to operate at unacceptable LOS F with 122.9 seconds of delay during the weekday p.m. peak hour. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour. A similar impact was identified under Year 2030 Alternative A Conditions.
- Route 1 / Route 26. This signalized study intersection currently operates at acceptable LOS C with 27.9 seconds of delay and would operate at unacceptable LOS F with 87.6 seconds of delay during the weekday p.m. peak hour under Existing Conditions and Year 2030 Baseline

Conditions, respectively. Under Year 2030 Alternative B Conditions, this study intersection would continue to operate at unacceptable LOS F with 88.1 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection during the weekday p.m. peak hour. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour. A similar impact was identified under Year 2030 Alternative A Conditions.

- Route 16 / Route 27. This signalized study intersection currently operates at acceptable LOS D with 50.1 seconds of delay and LOS E with 71.2 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This study intersection would operate at unacceptable LOS F with greater than 180.0 seconds of delay and 154.7 seconds of delay during the weekday a.m. and p.m. peak hours, respectively under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay and 166.2 seconds of delay during the weekday a.m. and p.m. peak hours, respectively. The proposed action would add more than 50 vehicles to this poorly performing intersection during the weekday a.m. and p.m. peak hours. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours. A similar impact was identified under Year 2030 Alternative A Conditions.
- Route 16 / Route 10A. This signalized study intersection currently operates at unacceptable LOS F with 143.3 seconds of delay and would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative B Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection during the weekday a.m. peak hour. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour. A similar impact was identified under Year 2030 Alternative A Conditions.
- Route 15 / Route 26. This two-way stop-controlled intersection currently operates at unacceptable LOS F with 62.1 seconds of delay and 147.3 seconds of delay during the weekday a.m. and p.m. peak hours, respectively under Existing Conditions. This study intersection would continue to operate at unacceptable LOS F with 145.2 seconds of delay and greater than 180.0 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. and p.m. peak hours. The proposed action would add more than 50 vehicles to this poorly performing intersection during the weekday a.m. and p.m. peak hours. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours. No impacts were identified at this study intersection under Year 2030 Alternative A Conditions.
- Route 1 / Route 14A. This signalized study intersection currently operates at unacceptable LOS F with 156.1 seconds of delay during the weekday p.m. peak hour under Existing Conditions. This study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative B Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection during the weekday p.m. peak hour.

Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour. A similar impact was identified under Year 2030 Alternative A Conditions.

- Route 1 / Route 10A. This signalized study intersection currently operates at acceptable LOS E with 62.6 seconds of delay and would operate at unacceptable LOS F with 139.3 seconds of delay during the weekday p.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative B Conditions, this study intersection would continue to operate at unacceptable LOS F with 146.1 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour. A similar impact was identified under Year 2030 Alternative A Conditions.

To reduce impacts to less than significant levels on these study intersections, the following potential mitigation measures may be implemented:

- Potential Mitigation Measure Fin-S. Fin-Int-1: Implement Potential Mitigation Measure Fin-Int-1. With implementation of Potential Mitigation Measure Fin-Int-1, traffic operations at Route 3 / 9 / Chalan Santa Anita would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Int-2: Implement Potential Mitigation Measure Fin-Int-2. With implementation of Potential Mitigation Measure Fin-Int-2, traffic operations at Route 3 / Royal Palm Drive would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Int-3: Implement Potential Mitigation Measure Fin-Int-3. With implementation of Potential Mitigation Measure Fin-Int-3, traffic operations at Route 1 / Route 3 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Int-4: Implement Potential Mitigation Measure Fin-Int-4. With implementation of Potential Mitigation Measure Fin-Int-4, traffic operations at Route 1 / Route 27 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Int-5: Implement Potential Mitigation Measure Fin-Int-5. With implementation of Potential Mitigation Measure Fin-Int-5, traffic operations at Route 1 / Route 26 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Int-6: Implement Potential Mitigation Measure Fin-Int-6. With implementation of Potential Mitigation Measure Fin-Int-6, traffic operations at Route 16 / Route 27 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Int-7: Implement Potential Mitigation Measure Fin-Int-7. With implementation of Potential Mitigation Measure Fin-Int-7, traffic operations at Route 16 / Route 10A would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-S. Fin-Int-8: Implement Potential Mitigation Measure Fin-Int-8. With implementation of Potential Mitigation Measure Fin-Int-8, traffic operations at Route 1 / Route 14A would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)

- Potential Mitigation Measure Fin-S. Fin-Int-9: Implement Potential Mitigation Measure Fin-Int-9. With implementation of Potential Mitigation Measure Fin-Int-9, traffic operations at Route 1 / Route 10A would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)

Significant impacts would also occur at two locations and potential mitigation measures have not been identified:

- Route 15 / Chalan Lajuna (SI)
- Route 15 / Route 26 (SI)

The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies, to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Transit Conditions. Transit conditions under Alternative B with Alternative 1 would be the same as those described above for Alternative A with Alternative 1.

Pedestrian and Bicycle Conditions. Pedestrian and bicycle conditions under Alternative B with Alternative 1 would be the same as those described above for Alternative A with Alternative 1.

Public Health and Safety

The primary health and safety issue associated with the Alternative A and Alternative 1 combination is the potential for traffic incidents. The driving distance between the proposed Finegayan alternatives (Alternatives A or B) and the proposed Route 15 LFTRC alternative (Alternative 1) is approximately 7.8 miles (12.5 km). Vehicles would use Routes 3, 9, and 1 to commute between the Alternative A or Alternative B area and Alternative 1. No high-crash frequency intersections are situated along this travel route. Because the travel distance between Alternative A or Alternative B and Alternative 1 is relatively short and there are no high-frequency crash intersections situated along the travel route, no significant additive traffic impacts are expected to occur.

The proposed action would result in a substantial increase in vehicular traffic on Route 3, whose northern portions near the main cantonment lack shoulders or sidewalks. This would increase the potential for collisions with bicyclists and pedestrians at the locations where they are likely to be present, specifically, Artero Drive (Finegayan Elementary School and McDonald's) and Okkodo High School. Based on the hours of operation of Okkodo High School (6:45 a.m. to 3:00 p.m.) and the Guam Department of Public Works 2012-2013 bus schedule, the peak hour of school traffic would occur between 6 a.m. and 7 a.m. and 2:30 p.m. and 3:30 p.m. The peak hour of school traffic would not coincide or overlap with overall weekday peak traffic hours, which occur between 8:00 a.m. and 9:00 a.m. and between 4:30 p.m. and 5:30 p.m. Because peak school traffic would not coincide with overall weekday peak traffic hours, the increase in potential for collisions with children that would be commuting to school via walking or bicycle would be less than significant.

6.1.2.2 Finegayan Cantonment/Family Housing Alternative A or B with any NAVMAG LFTRC Alternative (Alternatives 2, 3, or 4)

Air Quality

The combined air quality impacts would be similar to those described Section 6.1.2.1. The combined construction island-wide impacts, similar to the emissions summarized in Table 6.1.2-1, would be less than significant as a result of these combined alternatives.

Terrestrial Biological Resources

Finegayan Cantonment/Family Housing Alternative A with NAVMAG (East/West) LFTRC Alternative 2

The additive impacts of implementing Cantonment Housing Alternative A, LFTRC Alternative 2, and the IT/COMM infrastructure are provided in Table 6.1.2-8. Overall, approximately 1,054 acres (428 ha) of limestone forest, or 5.6% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,326 acres (537 ha) of Overlay Refuge lands, or 6% of the total Overlay Refuge currently present on Guam, would be disturbed. The majority (95%) of the impacts to terrestrial biological resources would occur under Alternative A, with over 1,007 acres (408 ha) of limestone forest disturbed. The proposed IT/COMM alignment contributes very little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-8. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan Cantonment/Family Housing (Alternative A), NAVMAG (East/West) LFTRC (Alternative 2), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative A	2 (0.8)	1,005 (407)	1,243 (503)	MFB, MC, GR, GMK, Ser	MS, PSTG	MFB: 957 (387) MC: 957 (387) GR: 500 (202) GMK: 957 (387) Ser: 634 (257)
Alternative 2	0	19 (8)	0	-	-	MFB: 43 (17) MC: 43 (17) GR: 49 (20) GMK: 43 (17) Ser: 18 (7)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**6 (3)**	**1,048 (425)**	**1,326 (537)**	-	-	**MFB: 1,036 (419)** **MC: 1,037 (419)** **GR: 686 (278)** **GMK: 1,036 (419)** **Ser: 682 (276)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.

Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Finegayan Cantonment/Family Housing Alternative A with NAVMAG (North/South) LFTRC Alternative 3

The additive impacts of implementing Cantonment/Family Housing Alternative A, LFTRC Alternative 3, and the IT/COMM infrastructure are provided in Table 6.1.2-9. Overall, approximately 1,203 acres (487 ha) of limestone forest, or 6% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,601 acres (648 ha) of Overlay Refuge lands, or 7% of the total Overlay Refuge currently present on Guam, would be disturbed. The majority (83%) of the impacts to terrestrial biological resources would occur under Alternative A, with 1,007 acres (408 ha) of limestone forest disturbed. The proposed IT/COMM alignment contributes very little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-9. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan Cantonment/Family Housing (Alternative A), NAVMAG (North/South) LFTRC (Alternative 3), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative A	2 (0.8)	1,005 (407)	1,243 (503)	MFB, MC, GR, GMK, Ser	MS, PSTG	MFB: 957 (387) MC: 957 (387) GR: 500 (202) GMK: 957 (387) Ser: 634 (257)
Alternative 3	105 (42)	64 (26)	275 (111)	MFB, MC, GMK, MCM	PSTG	MFB: 223 (90) MC: 230 (93) GR: 24 (10) GMK: 223 (90) Ser: 40 (16)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**111 (45)**	**1,093 (442)**	**1,601 (648)**	**-**	**-**	**MFB: 1,216 (492)** **MC: 1,217 (493)** **GR: 661 (268)** **GMK: 1,216 (492)** **Ser: 704 (285)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MCM = Mariana common moorhen, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Finegayan Cantonment/Family Housing Alternative A with NAVMAG (L-Shaped) LFTRC Alternative 4

The additive impacts of implementing Cantonment/Family Housing Alternative A, LFTRC Alternative 4, and the IT/COMM infrastructure are provided in Table 6.1.2-10. Overall, approximately 1,165 acres (472 ha) of limestone forest, or 6% of the total limestone forest currently present on Guam, would be disturbed. Approximately 1,545 acres (625 ha) of Overlay Refuge lands, or 7% of the total Overlay Refuge currently present on Guam, would be disturbed. The proposed IT/COMM alignment contributes very little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-10. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan Cantonment/Family Housing (Alternative A), NAVMAG (L-Shaped) LFTRC (Alternative 4), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative A	2 (0.8)	1,005 (407)	1,243 (503)	MFB, MC, GR, GMK, Ser	MS, PSTG	MFB: 957 (387) MC: 957 (387) GR: 500 (202) GMK: 957 (387) Ser: 634 (257)
Alternative 4	67 (27)	63 (26)	219 (88)	MFB, MC, GMK	PSTG	MFB: 161 (65) MC: 166 (67) GR: 50 (20) GMK: 161 (65) Ser: 19 (8)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**73 (29)**	**1,092 (442)**	**1,545 (625)**	-	-	**MFB: 1,154 (467)** **MC: 1,160 (469)** **GR: 687 (278)** **GMK: 1,154 (467)** **Ser: 683 (276)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko; Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with NAVMAG (East/West) LFTRC Alternative 2

The additive impacts of implementing Cantonment/Family Housing Alternative B, LFTRC Alternative 2, and the IT/COMM infrastructure are provided in Table 6.1.2-11. Overall, approximately 862 acres (350 ha) of limestone forest, or 5% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,060 acres (429 ha) of Overlay Refuge lands, or 5% of the total Overlay Refuge currently present on Guam, would be disturbed. The vast majority (95%) of the impacts to terrestrial biological resources would occur under Alternative B, with 815 acres (330 ha) of limestone forest disturbed. The proposed IT/COMM alignment contributes very little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-11. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan/South Finegayan Cantonment/Family Housing (Alternative B), NAVMAG (East/West) LFTRC (Alternative 2), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative B	2 (0.8)	813 (329)	947 (383)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 754 (305) MC: 754 (305) GR: 571 (231) GMK: 754 (305) Ser: 619 (250)
Alternative 2	0	19 (8)	0	-	-	MFB: 43 (17) MC: 43 (17) GR: 49 (20) GMK: 43 (17) Ser: 18 (7)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**6 (3)**	**856 (347)**	**1,030 (417)**	-	-	**MFB: 833 (337)** **MC: 834 (338)** **GR: 757 (306)** **GMK: 833 (337)** **Ser: 667 (270)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko; Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with NAVMAG (North/South) LFTRC Alternative 3

The additive impacts of implementing Cantonment/Family Housing Alternative B, LFTRC Alternative 3, and the IT/COMM infrastructure are provided in Table 6.1.2-12. Overall, approximately 1,012 acres (410 ha) of limestone forest, or 5% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,305 acres (5284 ha) of Overlay Refuge lands, or 6% of the total Overlay Refuge currently present on Guam, would be disturbed. The majority (80%) of the impacts to vegetation communities would occur under Alternative B, with 815 acres (330 ha) of limestone forest disturbed. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-12. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan/South Finegayan Cantonment/Family Housing (Alternative B), NAVMAG (North/South) LFTRC (Alternative 3), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative B	2 (0.8)	813 (329)	947 (383)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 754 (305) MC: 754 (305) GR: 571 (231) GMK: 754 (305) Ser: 619 (250)
Alternative 3	105 (42)	64 (26)	275 (111)	MFB, MC, GMK, MCM	PSTG	MFB: 223 (90) MC: 230 (93) GR: 24 (10) GMK: 223 (90) Ser: 40 (16)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**111 (45)**	**901 (365)**	**1,305 (528)**			**MFB: 1,013 (410)** **MC: 1,021 (413)** **GR: 732 (296)** **GMK: 1,013 (410)** **Ser: 689 (279)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko; Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with NAVMAG (L-Shaped) LFTRC Alternative 4

The additive impacts of implementing Cantonment/Family Housing Alternative B, LFTRC Alternative 4, and the IT/COMM infrastructure are provided in Table 6.1.2-13. Overall, approximately 973 acres (394 ha) of limestone forest, or 5% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,249 acres (506 ha) of Overlay Refuge lands, or 6% of the total Overlay Refuge currently present on Guam, would be disturbed. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-13. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan/South Finegayan Cantonment/Family Housing (Alternative B), NAVMAG (L-Shaped) LFTRC (Alternative 4), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative B	2 (0.8)	813 (329)	947 (383)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 754 (305) MC: 754 (305) GR: 571 (231) GMK: 754 (305) Ser: 619 (250)
Alternative 4	67 (27)	63 (26)	219 (88)	MFB, MC, GMK	PSTG	MFB: 161 (65) MC: 166 (67) GR: 50 (20) GMK: 161 (65) Ser: 19 (8)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**73 (29)**	**900 (365)**	**1,249 (506)**	-	-	**MFB: 951 (385)** **MC: 957 (387)** **GR: 758 (307)** **GMK: 951 (385)** **Ser: 668 (270)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko; Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Cultural Resources

Finegayan Cantonment/Family Housing Alternative A with any NAVMAG LFTRC Alternative (Alternatives 2, 3, or 4)

Adverse effects to historic properties under NHPA and impacts to other cultural resources of cultural importance resulting from the implementation of Alternative A and Alternatives 2, 3, or 4 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. Construction for the IT/COMM lines for Alternative A and Alternatives 2, 3, or 4 would occur along Routes 1, 2A, 3, 3A, 4, 4A, 5, 8, 9, 10, 15, 16, and 17. In general, IT/COMM lines would follow existing roads; however, additional lines would be constructed at AAFB and from AAFB to Finegayan. Approximately 48% of these areas have been previously surveyed (Thomas and Price 1979; Davis 1983; April 1984; Haun 1988; Kurashina *et al.* 1988; Amesbury and Moore 1989; Moore *et al.* 1988; Moore and Amesbury 1989; Highness and Haun 1990; Amesbury *et al.* 1991; Carrell 1991; Russell and Guerrero 1991; Prasad and Moore 1992; Russell *et al.* 1993; Henry *et al.* 1994, 1999; Hunter-Anderson 1994; Reinman 1995; Wells *et al.* 1995; Workman and Haun 1995; Hunter-Anderson *et al.* 1997; Reinman and Nees 1998; Olmo *et al.* 2000; Hunter-Anderson *et al.* 1995, 2001; Kurashina *et al.* 1987; Liston 1996; Hunter-Anderson and Moore 2002, 2003; Dixon *et al.* 1999, 2004, 2011a, 2011b, 2015a, 2015b; Yee *et al.* 2004; DeFant and Guerrero 2006; Hunter-Anderson 2002, 2004; Grant *et al.* 2007; Church *et al.* 2009; Athens 2009; Welch 2010; Dixon and Walker 2011; DeFant 2013). As not all of the routes have been surveyed, a literature review of previous surveys and sites located within the construction corridor was undertaken and the

likelihood of finding buried cultural resources within PDIA for the IT/COMM lines corridor was assessed based on the level of disturbance, the proximity of known sites, and historic land use (Dixon *et al.* 2014). Within the PDIA for the IT/COMM lines, 39% of Route 1, 61% of Route 2A, 100% of Route 3, 54% of Route 3A, 11% of Route 4, 100% of Route 4A, 16% of Route 5, 90% of Route 8, 64% of Route 9, none of Route 10, 59% of Route 15, 55% of Route 16, and 2% of Route 17 have been surveyed.

Table 6.1.2-14 lists 12 known archaeological sites within the IT/COMM lines PDIA for Alternatives 2, 3, and 4. One site, a portion of NWF, is eligible for inclusion in the NRHP. Eleven archaeological sites are not eligible for listing in the NRHP. The literature review indicated that there are also areas that were not previously surveyed that have potential for buried cultural resources along Routes 1, 5, 15 and 17.

Table 6.1.2-14. Archaeological Sites within the IT/COMM Lines Potential Impacted Area for Finegayan Cantonment/Family Housing (Alternative A) and LFTRC Alternatives 2, 3, or 4

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
	36*	Flagpole	Post-WWII/Second American Territorial	Lauter-Reinman 1997	No	NA
	377*	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
	1066*	Concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-07-2119	1001*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle dump	Post-WWII/ Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-08-0213	T-16	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
66-08-1065***		Airfield	Post-WWII/ Second American Territorial	Aaron *et al.* 2007	Yes	A
	T-A4S-5	Concrete pads	Post-WWII/ Second American Territorial	Dixon and Walker 2011	No	NA
	T-H-1	Artifact scatter & concrete foundations	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/Latte; WWII Japanese Military Occupation, Second American Territorial	Dixon *et al.* 2014	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

*Map Numbers from Welch (2009) (Map no. 36, 235, 377, and 493) or Welch (2010) (Map no. 1066).

**Revised to match Guam GHPI forms dated May 28, 2014.

***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

One structure eligible for listing in the NRHP, North Field, is also located within the potential impacted area for Alternatives 2, 3, and 4. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

The installation of IT/COMM links between Alternative A and the LFTRC Alternatives 2, 3, or 4 has the potential to result in adverse effects from excavation and soil removal to two historic properties, including one NRHP-eligible archaeological site (see Table 6.1.2-14) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be directly affected by the construction of the IT/COMM links.

No direct or indirect adverse effects are anticipated to occur due to operation of the IT/COMM utilities as these lines would be buried and there would be no change in use and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with any NAVMAG LFTRC Alternative (Alternatives 2, 3, or 4)

Adverse effects to historic properties under NHPA and impacts to other cultural resources of cultural importance resulting from the implementation of Alternative B and Alternatives 2, 3 or 4 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. The PDIA for the IT/COMM lines for these site combinations would be similar to those described above for Alternative A and Alternatives 2, 3, or 4. The installation of IT/COMM links between the Alternative B and the LFTRC Alternatives 2, 3, or 4 has the potential to result in adverse effects from excavation and soil removal to two historic properties--one NRHP-eligible archaeological site (see Table 6.1.2-14) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining area. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

No direct or indirect adverse effects due to operation of the IT/COMM utilities would occur as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

Finegayan Cantonment/Family Housing Alternative A with any NAVMAG LFTRC Alternative (Alternatives 2, 3, or 4)

Alternative A was modeled with Alternative 5 (Section 3.12.1). Pairing Alternative A with Alternative 2, 3, or 4 may result in a slight increase in vehicles (less than 5%) on roadway segments and at intersections that comprise the most direct route between the Alternative A Main Gate and the Alternative 2, 3, or 4 gates, as well as a slight decrease in vehicles on roadway segments and at intersections that comprise the most direct route between the modeled combination Alternative A Main Gate and the Alternative 5 gate. This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route.

Roadway Segment Operations. Impacts and potential mitigation measures for all off-base (external) roadway segments would be the same as those identified in Section 6.1.2.1 (see Table 6.1.2-6). Significant impacts were identified on eight roadway segments. Potential mitigation measures would be feasible at all locations and could reduce the identified significant impacts to less than significant levels. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

Intersection Operations. Impacts and potential mitigation measures for all intersections would be the same as those identified in Section 6.1.2.1 (see Table 6.1.2-6). Significant impacts were identified at nine intersections. Potential mitigation measures would be feasible at all locations and could reduce the identified significant impacts to less than significant levels. The detailed results of the intersection analysis are provided in its entirety in Appendix F.

Transit Conditions. Transit conditions under Alternative A with Alternative 2, 3, or 4, would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Pedestrian and Bicycle Conditions. Pedestrian and bicycle conditions under Alternative A with Alternative 5 would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with any NAVMAG LFTRC Alternative (Alternatives 2, 3, or 4)

Alternative B was modeled with Alternative 2 or 4 (see Section 3.12.1). Pairing Alternative B with Alternative 3 may result in a slight increase in vehicles (less than 5%) on roadway segments and at intersections along the most direct route between the Alternative B Main Gate and the Alternative 3 gate, and a slight decrease in vehicles on roadway segments and at intersections along the most direct route between the modeled combination of Alternative B Main Gate and the Alternative 2 or 4 gates (see Figure 6.1.2-2). This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route.

Roadway Segment Operations. Impacts and potential mitigation measures for all off-base (external) roadway segments under Alternative B with Alternative 2, 3, or 4 would be the same as those identified in Section 6.1.2.1 (see Table 6.1.2-7 and Table 6.1.2-12) for Alternative B with Alternative 1. Significant impacts were identified on 10 roadway segments and potential mitigation measures were identified for 8 roadway segments. Potential mitigation measures have not been identified for these two locations. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

Intersection Operations. Impacts and potential mitigation measures for all study intersections under Alternative B with Alternative 2, 3, or 4 would be the same as those identified in Section 6.1.2.1 (see Table 6.1.2-7) for Alternative B with Alternative 1. Significant impacts were identified at 11 intersections

with potential mitigation measures identified for 9 intersections; potential mitigation measures have not been identified for the remaining 2 intersections. The detailed results of the intersection analysis are provided in their entirety in Appendix F.

Transit Conditions. Transit conditions under Alternative B with Alternative 2, 3, or 4 would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Pedestrian and Bicycle Conditions. Pedestrian and bicycle conditions under Alternative B with Alternative 2, 3, or 4 would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Public Health and Safety

The potential for traffic incidents is the primary health and safety issue with potential for creating additive impacts from implementing a specific cantonment/family housing alternative with a specific LFTRC alternative. The driving distances between the Alternative A area and the proposed NAVMAG LFTRC alternatives (Alternatives 2, 3, and 4) is approximately 22.3 miles (35.9 km) to Alternative 2, and 27.9 miles (44.9 km) to Alternatives 3 and 4. Vehicles would use Routes 1 and 3 to commute between the Alternative A or B areas and Alternative 1, while Routes 3, 4, 10, and 16, as well as a new roadway in Dandan, would be used to access Alternatives 3 and 4.

Five high-crash frequency intersections (intersections of Routes 1/3, Routes 1/14A, Routes 1/10A, Routes 1/14, and Routes 1/30) are situated along the travel route between the Alternative A and Alternative B area and Alternative 2. These intersections are primarily in the central portion of Guam in the highest developed area of the island, within the communities of Hagåtña and Tamuning. Two high-crash frequency intersections (intersection of Routes 1/3 and Routes 8/10/16) are situated along the travel route between the Alternative A and Alternative B area and the Alternatives 3 and 4. In an effort to improve vehicle safety at the intersection of Routes 8/10/16, traffic improvements were completed in 2012 that included the installation of a new traffic signal system that reduced congestion and channelized traffic. The travel distance between the Alternative A or Alternative B area and the NAVMAG alternatives is relatively long, and several high-frequency crash intersections are situated along the travel routes (resulting in a higher potential for being involved in a traffic incident or to be delayed because of traffic incidents). However, a less-than-significant additive impact on public health and safety is anticipated to occur since the additional vehicles traveling between the main cantonment and LFTRC would be an insignificant portion of total vehicles on these roadways.

6.1.2.3 Finegayan Cantonment/Family Housing Alternative A or B with NWF LFTRC Alternative 5

Air Quality

The combined air quality impacts would be the same as those described in Section 6.1.2.1. The combined construction island-wide emissions impacts, summarized in Table 6.1.2-1, would be less than significant as a result of this combined alternative.

Terrestrial Biological Resources

Finegayan Cantonment/Family Housing Alternative A with NWF LFTRC Alternative 5

The additive impacts of implementing Cantonment/Family Housing Alternative A, LFTRC Alternative 5, and the IT/COMM infrastructure are provided in Table 6.1.2-15. Overall, approximately 1,254 acres (508 ha) of limestone forest, or 7% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,624 acres (657 ha) of Overlay Refuge lands, or 7% of the total Overlay Refuge currently present on Guam, would be disturbed. The proposed IT/COMM alignment contributes

little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-15. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan Cantonment/Family Housing (Alternative A), NWF LFTRC (Alternative 5), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*	*Critical Habitat (acres [ha])*
Alternative A	2 (0.8)	1,005 (407)	1,243 (503)	MFB, MC, GR, GMK, Ser	MS, PSTG	MFB: 957 (387) MC: 957 (387) GR: 500 (202) GMK: 957 (387) Ser: 634 (257)	NA
Alternative 5	89 (36)	130 (53)	298 (121)	MFB, MC, GMK, Ser	-	MFB: 215 (87) MC: 215 (87) GR: 82 (33) GMK: 215 (87) Ser: 177 (71)	MFB, MC, GMK: 11 (5)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)	NA
Total	**95 (39)**	**1,159 (469)**	**1,624 (657)**	-		**MFB: 1,208 (489) MC: 1,209 (489) GR: 719 (291) GMK: 1,208 (489) Ser: 841 (340)**	-

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*, NA = not applicable.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with NWF LFTRC Alternative 5

The additive impacts of implementing Cantonment/Family Housing Alternative B, LFTRC Alternative 5, and the IT/COMM infrastructure are provided in Table 6.1.2-16. Overall, approximately 1,062 acres (430 ha) of limestone forest, or 6% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,328 acres (537 ha) of Overlay Refuge lands, or 6% of the total Overlay Refuge currently present on Guam, would be disturbed. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-16. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan/South Finegayan Cantonment/Family Housing (Alternative B), NWF LFTRC (Alternative 5), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*	*Critical Habitat (acres [ha])*
Alternative B	2 (0.8)	813 (329)	947 (383)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 754 (305) MC: 754 (305) GR: 571 (231) GMK: 754 (305) Ser: 619 (250)	NA
Alternative 5	89 (36)	130 (53)	298 (121)	MFB, MC, GMK, Ser	-	MFB: 215 (87) MC: 215 (87) GR: 82 (33) GMK: 215 (87) Ser: 177 (71)	MFB, MC, GMK: 11 (5)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)	NA
Total	**95 (39)**	**967 (391)**	**1,328 (537)**	-	-	**MFB: 1,005 (407)** **MC: 1,006 (407)** **GR: 790 (320)** **GMK: 1,005 (407)** **Ser: 826 (334)**	-

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko; NA = not applicable, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Cultural Resources

Finegayan Cantonment/Family Housing Alternative A with NWF LFTRC Alternative 5

Adverse effects to historic properties under NHPA and impacts to other cultural resources of cultural importance resulting from the implementation of Alternatives A and 5 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. Construction for the IT/COMM lines for Alternative A and Alternative 5 would occur along Routes 1, 2A, 3, 3A, 4, 4A, 5, 9, 10, 15, and 17. In general, IT/COMM lines would follow existing roads; however, additional lines would be constructed at AAFB and from AAFB to Finegayan. Approximately 44% of these areas have been previously surveyed (Davis 1983; April 1984; Kurashina *et al.* 1988; Moore *et al.* 1988; Amesbury and Moore 1989; Moore and Amesbury 1989; Russell and Guerrero 1991; Henry *et al.* 1996, 1999; Hunter-Anderson 1994; Reinman and Nees 1998; Olmo *et al.* 2000; Hunter-Anderson *et al.* 2001; Allen *et al.* 2002; Hunter-Anderson 2002; Hunter-Anderson and Moore 2002, 2003; Dixon *et al.* 2004, 2011a, 2011b, 2015a, 2015b; Yee *et al.* 2004, DeFant and Guerrero 2006; Grant *et al.* 2007; Church *et al.* 2009; Athens 2009; Welch 2010; Dixon and Walker 2011; DeFant 2013). As not all of the routes have been surveyed, a literature review of previous surveys and sites located within the construction corridor was undertaken and the likelihood of finding buried cultural resources within PDIA for the IT/COMM lines corridor was assessed based on the level of disturbance, the proximity of known sites, and historic land use (Dixon *et al.* 2014). Within the PDIA for the IT/COMM lines, approximately 1% of Route 1, 57% of Route 2A,

100% of Route 3, 49% of Route 3A, 1% of Route 4, 100% of Route 4A, 16% of Route 5, 64% of Route 9, none of Route 10, 59% of Route 15, and 1% of Route 17 have been surveyed.

Table 6.1.2-17 lists 17 known archaeological sites within the IT/COMM lines PDIA. Five of the sites, two artifact scatters, a Japanese defensive complex, a historic encampment, and portions of NWF, are eligible for inclusion on the NRHP. Twelve archaeological sites are not eligible for listing in the NRHP. The literature review indicated that there are also areas that were not previously surveyed that have potential for buried cultural resources along Routes 1, 5, 15, and 17.

Table 6.1.2-17. Archaeological Sites within the IT/COMM Utilities Potential Impacted Area for Finegayan Cantonment/Family Housing Alternative A with NWF LFTRC (Alternative 5)

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-02-1657	493*	Japanese defensive complex	WWII Japanese Military Occupation	Allen *et al.* 2002	Yes	D
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-07-2119	1001*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle dump	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Grant *et al.* 2007	No	NA
66-07-2128	1010*	Concrete pad	Post-WWII/Second American Territorial	Grant *et al.* 2007	No	NA
66-07-2321		Ceramic/ artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-1065***		Airfield	Post-WWII/Second American Territorial	Aaron *et al.* 2007	Yes	A
66-08-2305	ANT-6/1028	Encampment	Post-WWII/Second American Territorial	Welch 2010	Yes	D
66-08-2308***	ANT-10/1034	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/Latte; WWII Japanese Military Occupation, Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
	T-A4S-5	Concrete pads	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
	T-H-1	Artifact scatter and concrete foundation	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
	T-MSAU-1	Japanese dump and groundstone tool	Pre-Contact/Latte, WWII Japanese Military Occupation	Church *et al.* 2009	No	NA
	36*	Flagpole	Post-WWII/Second American Territorial	Lauter-Reinman 1997	No	NA
	377*	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
	1066*	MARBO base command area remnants - concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.
*From Welch (2009) (Map no. 36, 377, and 493) or Welch (2010) (map no. 1066).
**Revised to match Guam GHPI forms dated May 28, 2014.
***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

One structure eligible for listing in the NRHP, North Field, is located within the potential impacted area. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

The installation of IT/COMM links between Alternative A and the LFTRC Alternative 5 has the potential to result in adverse effects from excavation and soil removal to six historic properties, including five NRHP-eligible archaeological site (see Table 6.1.2-17) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be directly affected by the construction of the IT/COMM links.

No direct or indirect adverse effects due to operation of the IT/COMM utilities would occur as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with NWF LFTRC Alternative 5

Adverse effects to historic properties under NHPA and impacts to other cultural resources of cultural importance resulting from the implementation of Alternatives B and 5 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. The PDIA for the IT/COMM lines would be similar to those described for Alternative A and Alternative 5. The installation of IT/COMM links between Alternative B and the LFTRC Alternative 5 has the potential to result in adverse effects from excavation and soil removal to six historic properties, including five NRHP-eligible archaeological site (see Table 6.1.2-17) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-

eligible sites in the remaining areas. No TCPs would be affected by the construction of the IT/COMM links.

No direct or indirect adverse effects due to operation of the IT/COMM utilities would occur as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

Finegayan Cantonment/Family Housing Alternative A with NWF LFTRC Alternative 5

Alternative A was modeled with Alternative 5 (Section 3.12.1).

Roadway Segment Operations. Impacts and potential mitigation measures for all off-base (external) roadway segments under Alternative A with Alternative 5 would be the same as those identified in Section 6.1.2.1 for Alternative A with Alternative 1. Potential mitigation measures were identified for all impacted roadway segments, and if implemented, could reduce the impacts to less than significant levels. Significant impacts were identified on eight roadway segments. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

Intersection Operations. Impacts and potential mitigation measures for all intersections under Alternative A with Alternative 5 would be the same as those identified in Section 6.1.2.1 (see Table 6.1.2-6) for Alternative A with Alternative 1. Potential mitigation measures were identified for all impacted intersections, and if implemented, could reduce the impacts to less than significant levels. Significant impacts were identified at nine intersections. The detailed results of the intersection analysis are provided in its entirety in Appendix F.

Transit Conditions. Transit conditions under Alternative A with Alternative 5 would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Pedestrian and Bicycle Conditions. Pedestrian and bicycle conditions under Alternative A with Alternative 5 would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Finegayan/South Finegayan Cantonment/Family Housing Alternative B with NWF LFTRC Alternative 5

Alternative B was modeled with Alternative 2 or 4 (Section 3.12.1). Pairing Alternative B with Alternative 5 may result in a slight increase (less than 5%) in vehicles on roadway segments and at intersections along the most direct route between the Alternative B Main Gate and the Alternative 5 gate, and a slight decrease in vehicles on roadway segments and at intersections along the most direct route between the modeled combination, Alternative B Main Gate and the Alternative 2 or 4 gate (see Figure 6.1.2-2). This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route.

Roadway Segment Operations. Impacts and potential mitigation measures for all off-base (external) roadway segments would be the same as those identified in Section 6.1.2.1. Significant impacts were identified on 10 roadway segments. Potential mitigation measures were identified for 8 roadway segments and were not identified for 2 segments. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

Intersection Operations. Impacts and potential mitigation measures for all intersections would be the same as those identified in Section 6.1.2.1 (see Table 6.1.2-7). Significant impacts were identified at 11 intersections. Potential mitigation measures were identified for 9 intersections and were not identified for 2 intersections. The detailed results of the intersection analysis are provided in its entirety in Appendix F.

Transit Conditions. Transit conditions under Alternative B with Alternative 5 would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Pedestrian and Bicycle Conditions. Pedestrian and bicycle conditions under Alternative B with Alternative 5 would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Public Health and Safety

The potential for traffic incidents is the primary health and safety issue with potential for having additive impacts from implementing a specific cantonment/family housing alternative with a specific LFTRC alternative. The driving distance between the Alternative A or Alternative B area and the proposed NWF LFTRC alternative (Alternative 5) is approximately 4.4 miles (7.1 km). Vehicles would use Routes 3 and 3A to commute between either of these cantonment/family housing areas and Alternative 5. No high-crash frequency intersections are situated along this travel route. The travel distance between Alternative A or B and Alternative 5 is relatively short, and no high-frequency crash intersections are situated along this travel route. Therefore, no significant additive traffic impacts are anticipated.

6.1.2.4 AAFB Cantonment/Family Housing Alternative C with Route 15 LFTRC Alternative 1

Air Quality

The combined air quality impacts would be similar to those described in Section 6.1.2.1. The combined construction island-wide emissions, summarized in Table 6.1.2-18, would be below the significance criterion of 250 tpy for criteria pollutants resulting in less than significant as a result of this combined alternative.

Table 6.1.2-18. AAFB Cantonment/Family Housing (Alternative C) with Route 15 LFTRC (Alternative 1, 2, 3, 4, or 5) Annual Construction Emissions (2016-2022)

Construction Year	*Pollutant (tpy)*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
2016	neg	neg	neg	neg	neg	neg	neg
2017	0.1	3.5	0.3	0.3	5.3	0.7	724.7
2018	0.3	21.9	1.4	1.3	16.3	3.2	3176.9
2019	0.7	48.4	2.9	2.6	34.3	5.7	7625.4
2020	0.3	24.6	1.4	1.3	15.9	3.2	3540.8
2021	0.5	30.3	1.8	1.6	23.5	3.1	5219.8
2022	0.5	30.8	1.9	1.7	23.9	3.2	5309.9
Significance Threshold	250	250	250	250	250	250	NA

Legend: CO = Carbon Monoxide; CO_2 = Carbon Dioxide; NO_x= Nitrogen Oxides; PM_{10} = Particulate Matter (<10 microns); $PM_{2.5}$= Particulate Matter (<2.5 microns); SO_2 = Sulfur Dioxide; VOC = Volatile Organic Compounds; neg = negligible; NA = not available.

Terrestrial Biological Resources

The additive impacts of implementing Cantonment/Family Housing Alternative C, LFTRC Alternative 1, and the IT/COMM infrastructure are provided in Table 6.1.2-19. Overall, approximately 1,458 acres (590 ha) of limestone forest, or 8% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 972 acres (394 ha) of Overlay Refuge lands, or 4% of the total Overlay Refuge currently present on Guam, would be disturbed. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-19. Summary of Impacts to Terrestrial Biological Resources with Implementation of AAFB Cantonment/Family Housing (Alternative C), Route 15 LFTRC (Alternative 1), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative C	138 (56)	1,039 (420)	894 (362)	MFB, MC, GR, GMK, Ser	-	MFB: 1,159 (469) MC: 1,162 (470) GR: 228 (92) GMK: 1,159 (469) Ser: 1,093 (442)
Alternative 1	65 (26)	190 (77)	NA	GR	-	MFB: 81 (33) MC: 81 (33) GR: 283 (115) GMK: 81 (33) Ser: 67 (27)
IT/COMM	5 (2)	21 (9)	78 (32)	-	-	MFB: 30 (12) MC: 29 (12) GR: 140 (57) GMK: 30 (12) Ser: 22 (9)
Total	**208 (84)**	**1,250 (506)**	**972 (394)**	-	-	**MFB: 1,270 (514)** **MC: 1,272 (515)** **GR: 651 (264)** **GMK: 1,270 (514)** **Ser: 1,182 (478)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Cultural Resources

Adverse effects to historic properties under NHPA and impacts to other cultural resources of cultural importance resulting from the implementation of Alternatives C and 1 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. Construction for the IT/COMM lines for Alternative C and Alternative 1 would occur along Routes 1, 2A, 3, 3A, 4, 4A, 5, 9, 10, 15, and 17. In general, IT/COMM lines would follow existing roads; however, additional lines would be constructed at AAFB and from AAFB to Finegayan. Approximately 42% of these areas have been previously surveyed (Davis 1986; April 1984; Kurashina *et al.* 1987; Haun 1988; Kurashina *et al.* 1988; Moore *et al.* 1988; Amesbury and Moore 1989; Moore and Amesbury 1989; Highness and Haun 1990; Russell and Guerrero 1991; Tuggle 1993; Henry *et al.* 1996, 1999; Hunter-Anderson 1994; Liston 1996; Reinman and Nees 1998; Olmo *et al.* 2000; Hunter-Anderson *et al.* 2001; Allen *et al.* 2002; Hunter-Anderson 2002; Hunter-Anderson and Moore 2002, 2003; Dixon *et al.* 2004, 2011a, 2011b, 2015a,

2015b; Yee *et al.* 2004; DeFant and Guerrero 2006; Grant *et al.* 2007; Church *et al.* 2009; Athens 2009; Welch 2010; Dixon and Walker 2011; DeFant 2013). As not all of the routes have been surveyed, a literature review of previous surveys and sites located within the construction corridor was undertaken and the likelihood of finding buried cultural resources within PDIA for the IT/COMM lines corridor was assessed based on the level of disturbance, the proximity of known sites, and historic land use (Dixon *et al.* 2014). Within the PDIA for the IT/COMM lines, approximately 0.1% of Route 1, 57% of Route 2A, 100% of Route 3, 67% of Route 3A, 4% of Route 4, 100% of Route 4A, 16% of Route 5, 71% of Route 9, none of Route 10, 54% of Route 15, and 1% of Route 17 have been surveyed.

Table 6.1.2-20 lists 13 known archaeological sites within the IT/COMM lines PDIA. Three of the sites, including remnants of an encampment, a Latte Period artifact scatter, and portions NWF, are eligible to the NRHP. Ten archaeological sites are not eligible for listing in the NRHP. The literature review indicated that there are also areas that were not previously surveyed that have potential for buried cultural resources along Routes 1, 5, 15, and 17.

Table 6.1.2-20. Archaeological Sites within IT/COMM Lines Potential Impacted Area for AAFB Cantonment/Family Housing (Alternative C) and Route 15 LFTRC (Alternative 1)

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-07-2119	1001*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle dump	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-08-0213	T-16	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
66-08-1065***		Airfield	Post-WWII/Second American Territorial	Aaron *et al.* 2007	Yes	A
66-08-2305	ANT-6/1028	Encampment	Post-WWII/Second American Territorial	Welch 2010	Yes	D
66-08-2308***	ANT-10/1034	Artifact Scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/Latte; WWII Japanese Military Occupation, Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
	36*	Flagpole	Post-WWII/Second American Territorial	Lauter-Reinman 1997	No	NA
	377*	Ceramic Scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
	1066*	Concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA
	T-A4S-5	Concrete pads	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.
*From Welch 2009 (Map no. 36, 235, 377) and Welch 2010 (Map no. 1066).
**Revised to match Guam GHPI forms dated May 28, 2014.
***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

One structure eligible for listing in the NRHP, North Field, is located within the potential impacted area. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

The installation of IT/COMM links between Alternative C and the LFTRC Alternative 1 has the potential to result in adverse effects from excavation and soil removal to four historic properties--three NRHP-eligible archaeological sites (see Table 6.1.2-20) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be affected by the construction of the IT/COMM links.

No direct or indirect adverse effects due to operation of the IT/COMM utilities would occur as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

The travel demand modeling methodology for the combination of alternatives was defined and directed by the DoD and the FHWA to provide detailed off-base (external) roadway and intersection analysis for one representative pairing (the modeled combination) for a cantonment/family housing alternative and LFTRC site alternative. The modeled combination for Alternative C involved a pairing with Alternative 2 or 4 (see Section 3.12.1). Modeling results for this scenario indicate that weekday a.m. peak hour vehicle traffic related to the proposed action is generated solely by operations at the cantonment/family housing area. LFTRC-related traffic would occur prior to the weekday a.m. peak hour (8:00 a.m.) and may coincide with the weekday p.m. peak hour (4:30 p.m. to 5:30 p.m.) (see Section 5.1.12).

Operations of the LFTRC would increase traffic on the off-base (external) roadway segments and intersections that comprise the most direct route between the main cantonment gate and the LFTRC gates by approximately 38 vehicles (measured in passenger car equivalents) (see Table 5.1.12-2). LFTRC-related traffic represents an insubstantial amount of traffic (less than 5%) along the route. This minimal incremental increase in traffic volumes would not adversely affect LOS on roadways or at intersections along the route. The relative contribution from LFTRC traffic to the off-base (external) roadway segment and intersection impacts of each cantonment/family housing alternative would be minimal and would not vary appreciably with any LFTRC alternative (Alternative 1, 2, 3, 4, and 5). Therefore, the impacts to the off-base (external) roadway segments and intersections would be essentially the same for Alternative C with Alternative 1, Alternative C with Alternative 2, 3, or 4, and Alternative C with Alternative 5. A qualitative discussion of the potential effects of LFTRC-related traffic is provided for each combination.

Pairing Alternative C with Alternative 1 may result in a slight increase in vehicles (less than 5%) on roadway segments and at intersections that comprise the most direct route between the Alternative C Main Gate and the Alternative 1 gate, and a slight decrease in vehicles compared to the modeled combination, Alternative C Main Gate and the Alternative 2 or 4 gates (Figure 6.1.2-3). This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route.

The impacts to off-base (external) roadway segments and intersections are summarized in Table 6.1.2-21.

Table 6.1.2-21. Summary of Additive Impacts to Ground Transportation Resources with the AAFB Cantonment/Family Housing (Alternative C) and any LFTRC

#	***Roadway Segments****	***Intersections***
1	Route 1, from Route 29 to Chalan Lajuna (SI)**	Route 3 / 9 / Chalan Santa Anita (SI)
2	Route 1, from Route 34 to Route 16 (SI)	Route 3 / Royal Palm Drive (SI)
3	Route 3, from Finegayan Main Gate to Finegayan Residential Gate (SI)	Route 15 / Chalan Lajuna (SI)**
4	Route 3, from Finegayan Residential Gate to Route 28 (SI)	Route 1 / Route 3 (SI)
5	Route 15, from Route 26 to Barrigada South Gate (SI)**	Route 1 / Route 27 (SI)
6	Route 15, from Barrigada South Gate to Route 10 (SI)**	Route 1 / Route 26 (SI)
7	NA	Route 16 / Route 27 (SI)
8	NA	Route 16 / Route 10A (SI)
9	NA	Route 15 / Route 26 (SI)
10	NA	Route 1 / Route 14A (SI)
11	NA	Route 1 / Route 10A (SI)
Total	**6 (SI)**	**11 (SI)**

Legend: NA indicates not applicable. SI indicates significant impact. SI-M indicates significant but may be mitigated impact.
Note: * Includes impacts to roadway segments in at least one direction during one (or both) weekday a.m. or p.m. peak hours.
** Indicates an impact that would not occur under Year 2030 Alternative A Conditions.

Roadway Segment Operations. A capacity analysis was conducted to determine potential impacts to the off-base (external) roadway network during weekday a.m. and p.m. peak hours. The v/c ratio and LOS for each study roadway segment was compared to the baseline conditions to determine if any significant impacts would occur. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F. The addition of traffic generated by the proposed action may result in a potentially significant impact on six study roadway segments in at least one direction during the weekday a.m. and/or weekday p.m. peak hours.

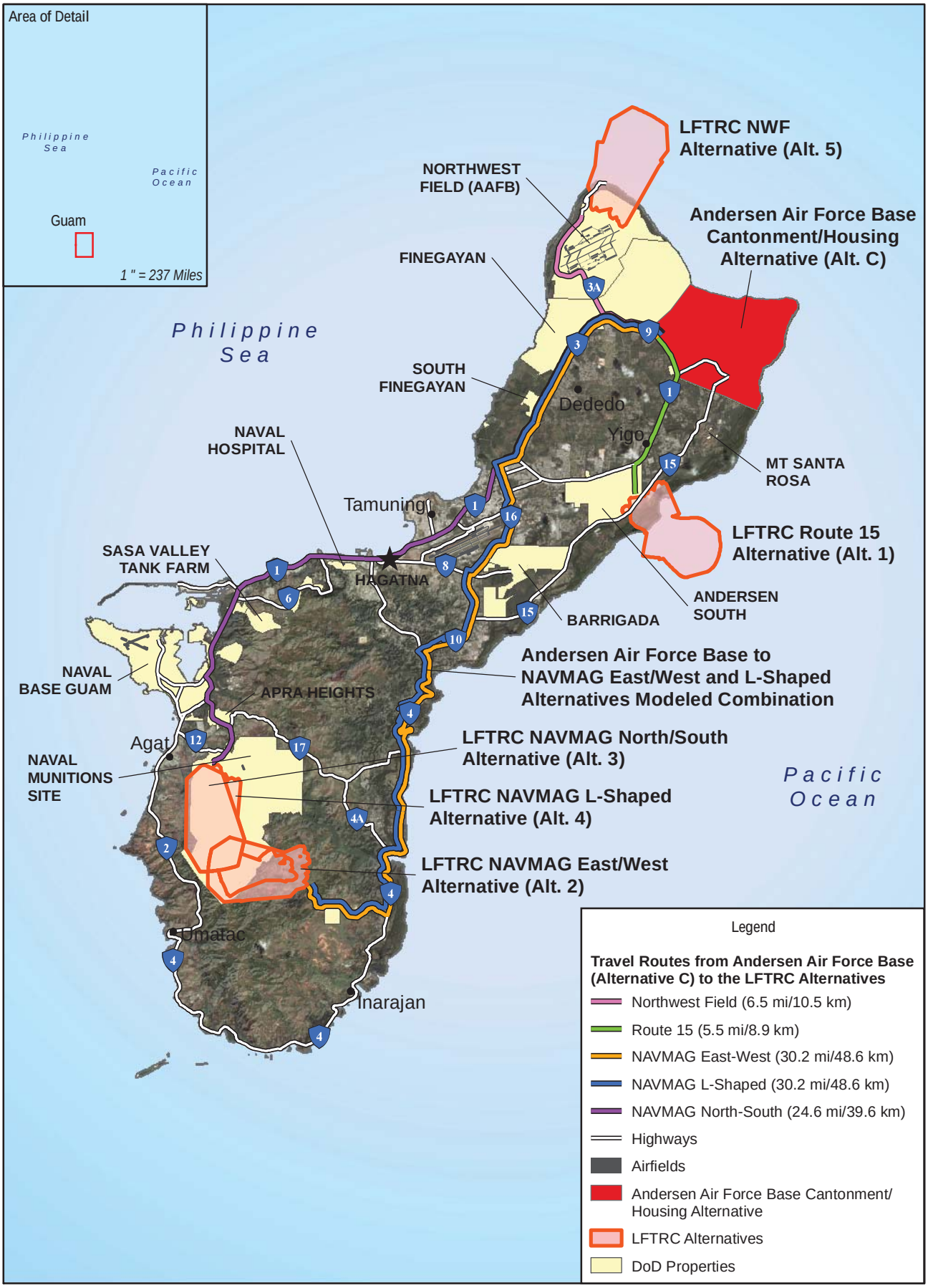


Figure 6.1.2-3
Travel Routes from Andersen Air Force Base Cantonment/ Housing (Alternative C) to the LFTRC Alternatives

Source: NAVFAC Pacific 2013

- Route 1, from Route 29 to Chalan Lajuna. This study roadway segment currently operates at acceptable LOS C with a v/c ratio of 0.78 in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS D with a v/c ratio of 0.86 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study roadway segment would degrade to operate at unacceptable LOS F with a v/c ratio of 1.02. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday p.m. peak hour.
- Route 1, from Route 34 to Route 16. This study roadway segment currently operates at acceptable LOS E with a v/c ratio of 0.96 in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS E with a v/c ratio of 0.97 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study roadway segment would degrade to unacceptable LOS F with a v/c ratio of 1.01. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday p.m. peak hour.
- Route 3, from Finegayan Main Gate to Finegayan Residential Gate. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.09 in the southbound/westbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.24 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.33. The proposed action would increase traffic on this study roadway segment by approximately 70 vehicles during the weekday p.m. peak hour. This 7.1% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound direction during the weekday a.m. peak hour.
- Route 3, from Finegayan Residential Gate to Route 28. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.23 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would continue to operate at LOS F with a v/c ratio of 1.36 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.45. The proposed action would increase the traffic on this study roadway segment by approximately 67 vehicles during the weekday a.m. peak hour. This 6.3% increase in traffic is greater than the 5.0% threshold of significance. During the weekday p.m. peak hour this study roadway segment currently operates at acceptable LOS D with a v/c ratio of 0.81 in the northbound/eastbound direction. This study roadway segment would operate at acceptable LOS E in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study roadway segment would degrade to unacceptable LOS F with a v/c ratio of 1.04. Therefore, the proposed action would result in a significant impact on this study roadway

segment in the southbound/westbound directions during the weekday a.m. peak hour and in the northbound/eastbound direction during the weekday p.m. peak hour.

- Route 15, from Route 26 to Barrigada South Gate. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.05 in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.06 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 118. The proposed action would increase traffic on this study roadway segment by approximately 90 vehicles during the weekday p.m. peak hour. This 10.6% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday a.m. peak hour.
- Route 15, from Barrigada South Gate to Route 10. This study roadway segment currently operates at acceptable LOS D with a v/c ratio of 0.90 in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.02 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.14. The proposed action would increase traffic on this study roadway segment by approximately 88 vehicles during the weekday a.m. peak hour. This 10.3% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday a.m. peak hour.

Significant impacts were identified for all impacted roadway segments. Potential mitigation measures for the impacted roadway segments would be similar in scope and scale to those identified in Section 6.1.2.1. However, the exact details of the improvements would require further evaluations and technical studies to determine their feasibility. The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives, and based on project-level technical studies to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Intersection Operations. Intersection analysis was conducted to determine potential impacts to the off-base (external) intersections during weekday a.m. and p.m. peak hours. The LOS for each study intersection is compared to the baseline conditions to determine if any significant impacts would occur. An impact summary is provided in Table 6.1.2-21. The detailed results of the intersection analysis are provided in their entirety in Appendix F.

The addition of traffic generated by the proposed action would potentially result in a significant impact at 11 study intersections during the weekday a.m. and/or weekday p.m. peak hours.

- Route 3 / 9 / Chalan Santa Anita. This two-way stop-controlled study intersection currently operates at acceptable LOS C with 21.9 seconds of delay and would operate at acceptable LOS E with 37.7 seconds of delay during the weekday a.m. peak hour under Existing Conditions and

Year 2030 Baseline Conditions, respectively. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study intersection would degrade to unacceptable LOS F with 134.6 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour.

- Route 3 / Royal Palm Drive. This two-way stop-controlled study intersection currently operates at acceptable LOS C with 16.3 seconds of delay and would operate at acceptable LOS E with 36.4 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study intersection would degrade to unacceptable LOS F with 50.6 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour.
- Route 15 / Chalan Lajuna. This two-way stop-controlled study intersection currently operates at acceptable LOS D with 30.7 seconds of delay and LOS C with 23.9 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This intersection would operate at unacceptable LOS F with 75.8 and 82.6 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Year 2030 Baseline Conditions. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study intersection would continue to operate at unacceptable LOS F with 119.9 and 166.3 seconds of delay during the weekday a.m. and p.m. peak hours, respectively. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours.
- Route 1 / Route 3. This signalized study intersection currently operates at LOS F and would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay and the proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour.
- Route 1 / Route 27. This signalized study intersection currently operates at acceptable LOS E with 70.3 seconds of delay and would operate at unacceptable LOS F with 118.3 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study intersection would continue to operate at unacceptable LOS F with 123.6 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour.
- Route 1 / Route 26. This signalized study intersection currently operates at acceptable LOS C with 27.9 seconds of delay and would operate at unacceptable LOS F with 87.6 seconds of delay during the weekday p.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study intersection would continue to operate at unacceptable LOS F with 95.7 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour.

- Route 16 / Route 27. This signalized study intersection currently operates at acceptable LOS D with 50.1 seconds of delay and acceptable LOS E with 71.2 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This signalized study intersection would operate at unacceptable LOS F with greater than 180.0 seconds of delay and 154.7 seconds of delay during the weekday a.m. and p.m. peak hours, respectively under Year 2030 Baseline Conditions. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay and 161.9 seconds of delay during the weekday a.m. and p.m. peak hours, respectively. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours.
- Route 16 / Route 10A. This signalized study intersection currently operates at unacceptable LOS F and would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour.
- Route 15 / Route 26. This two-way stop-controlled study intersection currently operates at unacceptable LOS F with 62.1 seconds of delay and 147.3 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This intersection would continue to operate at unacceptable LOS F with greater than 145.2 seconds of delay and greater than 180.0 seconds of delay during the weekday a.m. and p.m. peak hours, respectively under Year 2030 Baseline Conditions. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. and p.m. peak hours. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours.
- Route 1 / Route 14A. This signalized study intersection currently operates at unacceptable LOS F with 156.1 seconds of delay during the weekday p.m. peak hour under Existing Conditions. This study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour.
- Route 1 / Route 10A. This signalized study intersection currently operates at acceptable LOS E with 62.6 seconds of delay and would operate at unacceptable LOS F with 139.3 seconds of delay during the weekday p.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 AAFB Cantonment/Family Housing (Alternative C) Conditions, this study intersection would continue to operate at unacceptable LOS F with 141.6 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing

intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour.

Although significant impacts would occur at all intersections, potential mitigation measures have not been identified. Potential mitigation measures for the impacted intersections would be similar in scope and scale to those identified in Section 6.1.2.1. However, the exact details of the improvements would require further evaluations and technical studies to determine their feasibility. The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies, to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Transit Conditions. Transit conditions under Alternative C with Alternative 1 would be similar to those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Pedestrian and Bicycle Conditions. Pedestrian and bicycle conditions under Alternative C with Alternative 1 would be similar to those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Public Health and Safety

The potential for traffic incidents is the primary health and safety issue with potential for creating additive impacts from implementing a specific cantonment/family housing alternative with a specific LFTRC alternative. The driving distance between the proposed AAFB Cantonment/Family Housing (Alternative C) area and Alternative 1 is approximately 5.5 miles (8.8 km). Vehicles would use Route 9 to commute between the Alternative C area and Alternative 1. The travel distance between the Alternative C area and Alternative 1 is relatively short, and no high-frequency crash intersections are situated along the travel route. Therefore, no significant additive traffic impacts are anticipated.

6.1.2.5 AAFB Cantonment/Family Housing Alternative C with any NAVMAG LFTRC Alternative (Alternatives 2, 3, or 4)

Air Quality

The combined air quality impacts would be the same as those described in Section 6.1.2.4. The combined construction island-wide emissions, summarized in Table 6.1.2-18, would be less than significant as a result of these combined alternatives.

Terrestrial Biological Resources

AAFB Cantonment/Family Housing (Alternative C) with NAVMAG (North/South) LFTRC (Alternative 2)

The additive impacts of implementing Cantonment/Family Housing Alternative C, LFTRC Alternative 2, and the IT/COMM infrastructure are provided in Table 6.1.2-22. Overall, approximately 1,222 acres (495 ha) of limestone forest, or 6% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 972 acres (393 ha) of Overlay Refuge lands, or 4% of the total Overlay Refuge currently present on Guam, would be disturbed. The majority (96%) of the impacts to terrestrial biological resources would occur under Alternative C, with 1,177 acres (476 ha) of limestone forest disturbed. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources under this scenario relative to the other two components. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-22. Summary of Impacts to Terrestrial Biological Resources with Implementation of AAFB Cantonment/Family Housing (Alternative C), NAVMAG (East/West) LFTRC (Alternative 2), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative C	138 (56)	1,039 (420)	894 (362)	MFB, MC, GR, GMK, Ser	-	MFB: 1,159 (469) MC: 1,162 (470) GR: 228 (92) GMK: 1,159 (469) Ser: 1,093 (442)
Alternative 2	0	19 (8)	0	-	-	MFB: 43 (17) MC: 43 (17) GR: 49 (20) GMK: 43 (17) Ser: 18 (7)
IT/COMM	5 (2)	21 (8)	78 (32)	-	-	MFB: 30 (12) MC: 29 (12) GR: 140 (57) GMK: 30 (12) Ser: 22 (9)
Total	**143 (58)**	**1,079 (436)**	**972 (393)**	-	-	**MFB: 1,232 (499)** **MC: 1,275 (516)** **GR: 417 (169)** **GMK: 1,232 (499)** **Ser: 1,133 (459)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

AAFB Cantonment/Family Housing Alternative C with NAVMAG (North/South) LFTRC Alternative 3

The additive impacts of implementing Cantonment/Family Housing Alternative C, LFTRC Alternative 3, and the IT/COMM infrastructure are provided in Table 6.1.2-23. Overall, approximately 1,372 acres (555 ha) of limestone forest, or 7% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,247 acres (505 ha) of Overlay Refuge lands, or 6% of the total Overlay Refuge currently present on Guam, would be disturbed. The majority of the impacts to terrestrial biological resources would occur under Alternative C, with 1,177 acres (476 ha) of limestone forest disturbed. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources relative to the other components under this scenario. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-23. Summary of Impacts to Terrestrial Biological Resources with Implementation of AAFB Cantonment/Family Housing (Alternative C), NAVMAG (North/South) LFTRC (Alternative 3), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative C	138 (56)	1,039 (420)	894 (362)	MFB, MC, GR, GMK, Ser	-	MFB: 1,159 (469) MC: 1,162 (470) GR: 228 (92) GMK: 1,159 (469) Ser: 1,093 (442)
Alternative 3	105 (42)	64 (26)	275 (111)	MFB, MC, GMK, MCM	PSTG	MFB: 223 (90) MC: 230 (93) GR: 24 (10) GMK: 223 (90) Ser: 40 (16)
IT/COMM	5 (2)	21 (8)	78 (32)	-	-	MFB: 30 (12) MC: 29 (12) GR: 140 (57) GMK: 30 (12) Ser: 22 (9)
Total	**248 (100)**	**1,124 (455)**	**1,247 (505)**	-	-	**MFB: 1,412 (571)** **MC: 1,421 (575)** **GR: 392 (159)** **GMK: 1,412 (571)** **Ser: 1,155 (467)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MCM = Mariana common moorhen, MFB = Mariana fruit bat, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

AAFB Cantonment/Family Housing Alternative C with NAVMAG (L-Shaped) LFTRC Alternative 4

The additive impacts of implementing Cantonment/Housing Alternative C, LFTRC Alternative 4, and the IT/COMM infrastructure are provided in Table 6.1.2-24. Overall, approximately 1,333 acres (539 ha) of limestone forest, or 7% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,191 acres (482 ha) of Overlay Refuge lands, or 6% of the total Overlay Refuge currently present on Guam, would be disturbed. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-24. Summary of Impacts to Terrestrial Biological Resources with Implementation of AAFB Cantonment/Family Housing (Alternative C), NAVMAG (L-Shaped) LFTRC (Alternative 4), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative C	138 (56)	1,039 (420)	894 (362)	MFB, MC, GR, GMK, Ser	-	MFB: 1,159 (469) MC: 1,162 (470) GR: 228 (92) GMK: 1,159 (469) Ser: 1,093 (442)
Alternative 4	67 (27)	63 (26)	219 (88)	MFB, MC, GMK	PSTG	MFB: 161 (65) MC: 166 (67) GR: 50 (20) GMK: 161 (65) Ser: 19 (8)
IT/COMM	5 (2)	21 (8)	78 (32)	-	-	MFB: 30 (12) MC: 29 (12) GR: 140 (57) GMK: 30 (12) Ser: 22 (9)
Total	**210 (85)**	**1,123 (454)**	**1,191 (482)**	-	-	**MFB: 1,350 (546)** **MC: 1,357 (549)** **GR: 418 (169)** **GMK: 1,350 (546)** **Ser: 1,134 (459)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, PSTG = Pacific slender-toed gecko; Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Cultural Resources

Adverse effects to historic properties under NHPA and impacts to other cultural resources of cultural importance resulting from the implementation of Alternative C and 2, 3, or 4 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. Construction for the IT/COMM lines for Alternative C and Alternatives 2, 3, or 4 would occur along Routes 1, 2A, 3, 3A, 4, 4A, 5, 8, 9, 10, 15, 16, and 17. In general, IT/COMM lines would follow existing roads; however, additional lines would be constructed at AAFB and from AAFB to Finegayan. Approximately 50% of these areas have been previously surveyed (Thomas and Price 1979; Davis 1983; April 1984; Kurashina *et al.* 1987; Haun 1988; Kurashina *et al.* 1988; Moore *et al.* 1988; Amesbury and Moore 1989; Moore and Amesbury 1989; Highness and Haun 1990; Amesbury *et al.* 1991; Carrell 1991; Russell and Guerrero 1991; Prasad and Moore 1992; Tuggle 1993; Russell *et al.* 1993; Hunter-Anderson 1994; Reinman 1995; Wells *et al.* 1995; Workman and Haun 1995; Liston 1996; Hunter-Anderson *et al.* 1995, 1997; Reinman and Nees 1998; Olmo *et al.* 2000; Hunter-Anderson *et al.* 2001; Henry *et al.* 1999; Allen *et al.* 2002; Hunter-Anderson 2002, 2004; Hunter-Anderson and Moore 2002, 2003; Dixon *et al.* 1999, 2004, 2011a, 2011b, 2015a, 2015b; Yee *et al.* 2004; DeFant and Guerrero 2006; Grant *et al.* 2007; Church *et al.* 2009; Athens 2009; Welch 2010; Dixon and Walker 2011; DeFant 2013). As not all of the routes have been surveyed, a literature review of previous surveys and sites located within the construction corridor was undertaken and the likelihood of finding buried cultural resources within PDIA for the IT/COMM lines corridor was assessed based on the level of disturbance, the proximity of known sites, and historic land

use (Dixon *et al.* 2014). Within the PDIA for the IT/COMM lines, approximately 39% of Route 1, 61% of Route 2A, 100% of Route 3, 67% of Route 3A, 11% of Route 4, 100% of Route 4A, 16% of Route 5, 90% of Route 8, 71% of Route 9, none of Route 10, 59% of Route 15, 55% of Route 16, and 2% of Route 17 have been surveyed.

Table 6.1.2-25 lists 14 known archaeological sites within the IT/COMM lines PDIA for Alternatives 2, 3, and 4. Three of the sites, including remnants of an historic encampment, a Latte Period artifact scatter, and portions of NWF, are eligible for listing in the NRHP. Eleven archaeological sites are not eligible for listing in the NRHP. The literature review indicated that there are also areas that were not previously surveyed that have potential for buried cultural resources along Routes 1, 5, 15, and 17.

Table 6.1.2-25. Archaeological Sites within IT/COMM Lines Potential Impacted Area for the AAFB Cantonment/Family Housing (Alternative C) and LFTRC (Alternatives 2, 3, or 4)

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
	36*	Flagpole	Post-WWII/Second American Territorial	Lauter-Reinman 1997	No	NA
	377*	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
	1066*	Concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-07-2119	1001*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle dump	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-08-0213	T-16	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
66-08-1065***		Airfield	Post-WWII/Second American Territorial	Aaron *et al.* 2007	Yes	A
66-08-2305	ANT-6/1028	Encampment	Post-WWII/Second American Territorial	Welch 2010	Yes	D
66-08-2308***	ANT-10/1034	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
	T-A4S-5	Concrete pads	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
	T-H-1	Artifact scatter & concrete foundations	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/Latte; WWII Japanese Military/ Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

*Welch (2009) (Map no. 36, 235, 377, and 493) or Welch (2010) (Map no. 1066).

**Revised to match Guam GHPI forms dated May 28, 2014.

***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

One structure eligible for listing in the NRHP, North Field, is located within the potential impacted area for Alternatives 2, 3, and 4. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

The installation of IT/COMM links between Alternative C and the LFTRC Alternatives 2, 3, or 4 has the potential to result in adverse effects from excavation and soil removal to four historic properties-- three known NRHP-eligible archaeological sites (see Table 6.1.2-25) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be directly affected by the construction of the IT/COMM links.

No direct or indirect adverse effects due to operation of the IT/COMM utilities would occur as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

Alternative C was modeled with Alternative 2 or 4 (Section 3.12.1). Pairing Alternative C with Alternative 3 may result in a slight increase (less than 5%) in vehicles on roadway segments and at intersections that comprise the most direct route between the Alternative C Main Gate and the Alternative 3 gate, and a slight decrease in vehicles on roadway segments and at intersections that comprise the most direct route between the modeled combination, Alternative C Main Gate and the Alternative 2 or 4 gates (see Figure 6.1.2-3). This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route.

Although significant impacts would occur at all locations, potential mitigation measures have not been identified for any of the impacted roadway segments or intersections. Potential mitigation measures for would be similar in scope and scale to those identified in Section 6.1.2.1. However, the exact details of the improvements would require further evaluations and technical studies to determine their feasibility. The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies, to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Roadway Segment Operations. Impacts to all off-base (external) roadway segments would be the same as those identified in Section 6.1.2.4. Significant impacts were identified on six roadway segments. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

Intersection Operations. Impacts to all intersections would be the same as those identified in Section 6.1.2.4 (see Table 6.1.2-21). Significant impacts were identified at 11 intersections. The detailed results of the intersection analysis are provided in its entirety in Appendix F.

Transit Conditions. Transit conditions under Alternative C with Alternative 2, 3, or 4 would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Pedestrian and Bicycle Conditions. Pedestrian and bicycle conditions under Alternative C with Alternative 2, 3, or 4 would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Public Health and Safety

The potential for traffic incidents is the primary health and safety issue with potential for having additive impacts from implementing a specific cantonment/family housing alternative with a specific LFTRC alternative. The driving distance between the Alternative C area and Alternatives 2, 3, and 4 is approximately 24.6 miles (39.6 km) to Alternative 2, and 30.2 miles (48.6 km) to Alternatives 3 and 4. Vehicles would use Routes 1 and 3 to commute between the Alternative C area and Alternative 2, while Routes 3, 4, 10, and 16, as well as a new roadway in Dandan, would be used to access Alternatives 3 and 4.

Five high-crash frequency intersections (intersections of Routes 1/3, Routes 1/14A, Routes 1/10A, Routes 1/14, and Routes 1/30) are situated along the travel route between the Alternative C area and Alternative 2. These intersections are primarily in the central portion of Guam in the most highly developed area of the island, within the communities of Hagåtña and Tamuning. Two high-crash frequency intersections (intersection of Routes 1/3 and Routes 8/10/16) are situated along the travel route between the Alternative C area and Alternatives 3 and 4. The travel distance between the Alternative C area and Alternatives 2, 3, and 4 is relatively long, and several high-frequency crash intersections are situated along the travel routes (resulting in a higher potential for being involved in a traffic incident or to be delayed because of traffic incidents). However, a less-than-significant additive impact on public health and safety would occur since the additional vehicles traveling between the main cantonment and LFTRC would be an insignificant portion of total vehicles on these roadways.

6.1.2.6 AAFB Cantonment/Family Housing Alternative C with NWF LFTRC Alternative 5

Air Quality

The combined air quality impacts would be the same as those described in Section 6.1.2.4. The combined construction island-wide emissions, summarized in Table 6.1.2-18, would be less than significant as a result of these combined alternatives.

Terrestrial Biological Resources

The additive impacts of implementing Cantonment/Family Housing Alternative C, LFTRC Alternative 5, and the IT/COMM infrastructure are provided in Table 6.1.2-26. Overall, approximately 1,422 acres (575 ha) of limestone forest, or 8% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,270 acres (514 ha) of Overlay Refuge lands, or 6% of the total Overlay Refuge currently present on Guam, would be disturbed. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-26. Summary of Impacts to Terrestrial Biological Resources with Implementation of AAFB Cantonment/Family Housing (Alternative C), NWF LFTRC (Alternative 5), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*	*Critical Habitat (acres [ha])*
Alternative C	138 (56)	1,039 (420)	894 (362)	MFB, MC, GR, GMK, Ser	-	MFB: 1,159 (469) MC: 1,162 (470) GR: 228 (92) GMK: 1,159 (469) Ser: 1,093 (442)	NA
Alternative 5	89 (36)	130 (53)	298 (121)	MFB, MC, GMK, Ser	-	MFB: 215 (87) MC: 215 (87) GR: 82 (33) GMK: 215 (87) Ser: 177 (71)	MFB, MC, GMK: 11 (5)
IT/COMM	5 (2)	21 (8)	78 (32)	-	-	MFB: 30 (12) MC: 29 (12) GR: 140 (57) GMK: 30 (12) Ser: 22 (9)	NA
Total	**232 (94)**	**1,190 (481)**	**1,270 (514)**	-	-	**MFB: 1,404 (568)** **MC: 1,406 (569)** **GR: 450 (182)** **GMK: 1,404 (568)** **Ser: 1,292 (523)**	-

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, NA = not applicable; Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Cultural Resources

Adverse effects to historic properties under NHPA and impacts to other cultural resources of cultural importance resulting from the implementation of Alternatives C and 5 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. Construction for the IT/COMM lines for Alternative C and Alternative 5 would occur along Routes 1, 2A, 3, 3A, 4, 4A, 5, 9, 10, 15, and 17. In general, IT/COMM lines would follow existing roads; however, additional lines would be constructed at AAFB and from AAFB to Finegayan. Approximately 50% of these areas have been previously surveyed (Kurashina *et al.* 1987; Haun 1988; Kurashina *et al.* 1988; Moore *et al.* 1988; Amesbury and Moore 1989; Moore and Amesbury 1989; Highness and Haun 1990; Russell and Guerrero 1991; Tuggle 1993; Henry *et al.* 1996, 1999; Hunter-Anderson 1994; Liston 1996; Reinman and Nees 1998; Olmo *et al.* 2000; Hunter-Anderson *et al.* 2001; Allen *et al.* 2002; Hunter-Anderson 2002; Hunter-Anderson and Moore 2002, 2003; Dixon *et al.* 2004, 2011a, 2011b, 2015a, 2015b; Yee *et al.* 2004; DeFant and Guerrero 2006; Grant *et al.* 2007; Church *et al.* 2009; Athens 2009; Welch 2010; Dixon and Walker 2011; DeFant 2013). As not all of the routes have been surveyed, a literature review of previous surveys and sites located within the construction corridor was undertaken and the likelihood of finding buried cultural resources within PDIA for the IT/COMM lines corridor was assessed based on the level of disturbance, the proximity of known sites, and historic land use (Dixon *et al.* 2014). Within the PDIA for the IT/COMM lines, approximately 1% of Route 1, 57% of Route 2A, 100% of Route 3, 67% of Route

3A, 4% of Route 4, 100% of Route 4A, 16% of Route 5, 71% of Route 9, none of Route 10, 59% of Route 15, and 1% of Route 17 have been surveyed.

Table 6.1.2-27 lists 14 known archaeological sites within the IT/COMM lines PDIA. Three of the sites, including remnants of an historic encampment, a Latte Period artifact scatter, and portions of NWF, are eligible to the NRHP. Eleven archaeological sites are not eligible for listing in the NRHP. The literature review indicated that there are also areas that were not previously surveyed that have potential for buried cultural resources along Routes 1, 5, 15, and 17.

Table 6.1.2-27. Archaeological Sites within IT/COMM Lines Potential Impacted Area for AAFB Cantonment/Family Housing (Alternative C) and NWF LFTRC (Alternative 5)

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
	36*	Flagpole	Post-WWII/ Second American Territorial	Lauter-Reinman 1997	No	NA
	377*	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
	1066*	Concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-07-2119	1001*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle dump	Post-WWII/ Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Grant *et al.* 2007	No	NA
66-08-0213	T-16	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
66-08-1065***		Airfield	Post-WWII/ Second American Territorial	Aaron *et al.* 2007	Yes	A
66-08-2305	ANT-6/1028	Encampment	Post-WWII/ Second American Territorial	Welch 2010	Yes	D
66-08-2308***	ANT-10/1034	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
	T-A4S-5	Concrete pads	Post-WWII/ Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/Latte; WWII Japanese Military Occupation, Post-WWII/ Second American Territorial	Dixon *et al.* 2014	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

*From Welch (2009) (Map no. 36, 235, 377, 493) and Welch (2010) (Map no. 1066).

**Revised to match Guam GHPI forms dated May 28, 2014.

***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

One structure eligible for listing in the NRHP, North Field, is located within the potential impacted area. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

The installation of IT/COMM links between Alternative C and the LFTRC Alternative 5 has the potential to result in adverse effects from excavation and soil removal to four historic properties--three NRHP-eligible archaeological sites (see Table 6.1.2-27) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be directly affected by the construction of the IT/COMM links.

No direct or indirect adverse effects due to operation of the IT/COMM utilities would occur as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

Alternative C was modeled with Alternative 2 or 4 (Section 3.12.1). Pairing Alternative C with Alternative 5 may result in a slight increase (less than 5%) in vehicles on roadway segments and at intersections that comprise the most direct route between the Alternative C Main Gate and the Alternative 5 gate and a slight decrease in vehicles on roadway segments and at intersections that comprise the most direct route between the modeled combination, Alternative C Main Gate and the Alternative 2 or 4 gate (see Figure 6.1.2-3). This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route.

Although significant impacts would occur at all locations, potential mitigation measures have not been identified for any of the impacted roadway segments or intersections. Potential mitigation measures would be similar in scope and scale to those identified in Section 6.1.2.1. However, the exact details of the improvements would require further evaluations and technical studies to determine their feasibility. The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies, to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Roadway Segment Operations. Impacts to all off-base (external) roadway segments would be the same as those identified in Section 6.1.2.4. Significant impacts were identified on six roadway segments. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

Intersection Operations. Impacts to all intersections would be the same as those identified in Section 6.1.2.4 (Table 6.1.2-21). Significant impacts were identified at 11 intersections. The detailed results of the intersection analysis are provided in its entirety in Appendix F.

Transit Conditions. Transit conditions under Alternative C with Alternative 5 would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Pedestrian and Bicycle Conditions. Pedestrian and bicycle conditions under Alternative C with Alternative 5 would be the same as those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Public Health and Safety

The potential for traffic incidents is the primary health and safety issue with potential for having additive impacts from implementing a specific cantonment/family housing alternative with a specific LFTRC alternative. The driving distance between the Alternative C area and Alternative 5 is approximately 6.5 miles. Vehicles would use Routes 9 and 3A to commute between the Alternative C area and Alternative 5. No high-crash frequency intersections are situated along this travel route. Because the travel distance between the Alternative C area and Alternative 5 is relatively short and there are no high-frequency crash intersections situated along the travel route, no significant additive traffic impacts would occur.

6.1.2.7 Barrigada Cantonment/Family Housing Alternative D with Route 15 LFTRC Alternative 1

Air Quality

The combined air quality impacts would be similar to those described in Section 6.1.2.1.

The combined construction island-wide emissions impacts, summarized in Table 6.1.2-28, would be below the significance criterion of 250 tpy for criteria pollutants resulting in less than significant as a result of this combined alternative.

Table 6.1.2-28. Barrigada Cantonment/Family Housing (Alternative D) with Route 15 LFTRC (Alternative 1, 2, 3, 4 or 5) Annual Construction Emissions (2016-2022)

Construction Year	*Pollutant (tpy)*						
	SO_2	*CO*	*PM_{10}*	*$PM_{2.5}$*	*NO_x*	*VOC*	*CO_2*
2016	neg	neg	neg	neg	neg	neg	neg
2017	0.1	4.8	0.4	0.4	6.2	0.8	933.6
2018	0.5	31.3	2.0	1.8	23.6	4.2	4784.0
2019	0.6	43.9	2.6	2.3	30.8	5.2	6825.0
2020	0.3	20.3	1.2	1.0	12.5	2.8	2779.4
2021	0.7	41.4	2.5	2.2	32.1	4.3	7096.1
2022	0.3	19.0	1.2	1.0	14.7	2.0	3256.4
Significance Threshold	250	250	250	250	250	250	NA

Legend: CO = Carbon Monoxide; CO_2 = Carbon Dioxide; NO_x= Nitrogen Oxides; PM_{10} = Particulate Matter (<10 microns); $PM_{2.5}$= Particulate Matter (<2.5 microns); SO_2 = Sulfur Dioxide; VOC= Volatile Organic Compounds; neg = negligible; NA = not available.

Terrestrial Biological Resources

The additive impacts of implementing Cantonment Housing Alternative D, LFTRC Alternative 1, and the IT/COMM infrastructure are provided in Table 6.1.2-29. Overall, approximately 518 acres (210 ha) of limestone forest, or 3% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 126 acres (51 ha) of Overlay Refuge lands, or <1% of the total Overlay Refuge currently present on Guam, would be disturbed. In regards to recovery habitat for ESA-listed species, the greatest impact would be to Guam rail recovery habitat with 1,291 acres (522 ha) developed, mostly associated with Alternative D. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-29. Summary of Impacts to Terrestrial Biological Resources with Implementation of Barrigada Cantonment/Family Housing (Alternative D), Route 15 LFTRC (Alternative 1), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative D	99 (40)	133 (54)	48 (19)	GR	-	MFB: 48 (19) MC: 48 (19) GR: 864 (350) GMK: 48 (19) Ser: 41 (17)
Alternative 1	65 (26)	190 (77)	NA	GR	-	MFB: 81 (33) MC: 81 (33) GR: 283 (115) GMK: 81 (33) Ser: 67 (27)
IT/COMM	6 (2)	25 (10)	78 (32)	-	-	MFB: 50 (20) MC: 50 (20) GR: 144 (58) GMK: 50 (20) Ser: 42 (17)
Total	**170 (69)**	**348 (141)**	**126 (51)**	-	-	**MFB: 179 (72)** **MC: 179 (72)** **GR: 1,291 (522)** **GMK: 179 (72)** **Ser: 150 (61)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Cultural Resources

Adverse effects to historic properties under NHPA and impacts to other cultural resources of cultural importance resulting from the implementation of Alternatives D and 1 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. Construction for the IT/COMM lines for Alternative D and Alternative 1 would occur along Routes 1, 2A, 3, 3A, 4, 4A, 5, 8, 9, 10, 15, 16, and 17. In general, IT/COMM lines would follow existing roads; however, additional lines would be constructed at AAFB and from AAFB to Finegayan. Approximately 48% of these areas have been previously surveyed (Kurashina *et al.* 1987; Davis 1983; April 1984; Haun 1988; Kurashina *et al.* 1988; Amesbury and Moore 1989; Moore and Amesbury 1989; Highness and Haun 1990; Russell and Guerrero 1991; Henry *et al.* 1996, 1999; Hunter-Anderson 1994; Liston 1996; Reinman and Nees 1998; Olmo *et al.* 2000; Allen *et al.* 2002; Hunter-Anderson 2002; Hunter-Anderson and Moore 2002, 2003; Dixon *et al.* 2004, 2011a, 2011b, 2015a, 2015b; Yee *et al.* 2004; DeFant and Guerrero 2006; Grant *et al.* 2007; Church *et al.* 2009; Athens, 2009; Welch 2010; Dixon and Walker 2011; DeFant 2013). As not all of the routes have been surveyed, a literature review of previous surveys and sites located within the construction corridor was undertaken and the likelihood of finding buried cultural resources within PDIA for the IT/COMM lines corridor was assessed based on the level of disturbance, the proximity of known sites, and historic land use (Dixon *et al.* 2014). Within the PDIA for the IT/COMM lines, approximately 12% of Route 1, 57% of Route 2A, 100% of Route 3, 67% of Route 3A, 4% of Route 4, 100% of Route 4A, 16% of Route 5, none of Route 8, 70% of Route 9, 1% of Route 10, 67% of Route 15, 50% of Route 16, 1% and 2% of Route 17 have been surveyed.

Table 6.1.2-30 lists 15 known archaeological sites within the IT/COMM lines PDIA. Four of the sites, including remnants of an historic encampment, two Latte Period artifact scatters, and portions of NWF, are eligible to the NRHP. Eleven archaeological sites are not eligible for listing in the NRHP. The literature review indicated that there are also areas that were not previously surveyed that have potential for buried cultural resources along Routes 1, 5, 15, and 17.

Table 6.1.2-30. Archaeological Sites within the IT/COMM Lines Potential Impacted Area for Barrigada Cantonment/Family Housing (Alternative D) and the Route 15 LFTRC (Alternative 1)

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
	36*	Flagpole	Post-WWII/Second American Territorial	Lauter-Reinman 1997	No	NA
	377*	Ceramic Scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
	1066*	Concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-07-2119	1001*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle dump	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2321	T-11/1046*	Ceramic/ artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-0213	T-16	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
66-08-1065***		Airfield	Post-WWII/Second American Territorial	Aaron *et al.* 2007	Yes	A
66-08-2305	ANT-6/1028	Encampment	Post-WWII/Second American Territorial	Welch 2010	Yes	D
66-08-2308***	ANT-10/1034	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
	T-H-1	Artifact scatter and concrete foundations	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
	T-A4S-5	Concrete pads	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/Latte; WWII Japanese Military Occupation, Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

*From Welch (2009) (Map no. 36, 377, 493) and Welch (2010) (Map no. 1066).

**Revised to match Guam GHPI forms dated May 28, 2014.

***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

One structure eligible for listing in the NRHP, North Field, is located within the potential impacted area. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

The installation of IT/COMM links between Alternative D and the LFTRC Alternative 1 has the potential to result in adverse effects from excavation and soil removal to five historic properties--four NRHP-eligible archaeological sites (see Table 6.1.2-30) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be directly affected by the construction of the IT/COMM links.

No direct or indirect adverse effects due to operation of the IT/COMM utilities would occur as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

The travel demand modeling methodology for the combination of alternatives was defined and directed by the DoD and the FHWA to provide detailed off-base (external) roadway and intersection analysis for one representative pairing (the modeled combination) for a cantonment/family housing alternative and LFTRC site alternative. The modeled combination for Alternative D involved a pairing with Alternative 5 (see Section 3.12.1). Modeling results for this scenario indicate that weekday a.m. peak hour vehicle traffic related to the proposed action is generated solely by operations at the cantonment/family housing area. LFTRC-related traffic would occur prior to the start weekday a.m. peak hour (8:00 a.m.) and may coincide with the weekday p.m. peak hour (4:30 p.m. to 5:30 p.m.) (see Section 5.1.12).

Operations of the LFTRC would increase traffic on the off-base (external) roadway segments and intersections that comprise the most direct route between the main cantonment gate and the LFTRC gates by approximately 38 vehicles (measured in passenger car equivalents) (see Table 5.1.12-2). LFTRC-related traffic represents an insubstantial amount of traffic (less than 5%) along the route. This minimal incremental increase in traffic volumes would not adversely affect LOS on roadways or at intersections along the route. The relative contribution from LFTRC traffic to the off-base (external) roadway segments and intersections under each cantonment/family housing alternative would be minimal and would not vary appreciably with any LFTRC alternative (Alternative 1, 2, 3, 4, and 5). Therefore, the impacts to the off-base (external) roadway segments and intersections would be essentially the same for Alternative D with Alternative 1, Alternative D with Alternative 2, 3, or 4, and Alternative D with Alternative 5. A qualitative discussion of the potential effects of LFTRC-related traffic is provided for each combination.

Pairing Alternative D with Alternative 1 may result in a slight increase in vehicles (less than 5%) on roadway segments and at intersections that comprise the most direct route between the Alternative D Main Gate and the Alternative 1 gate, and a slight decrease in vehicles compared to the modeled combination of Alternative D Main Gate and the Alternative 5 gate (Figure 6.1.2-4). This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route. The impacts to off-base (external) roadway segments and intersections are summarized in Table 6.1.2-31.

Table 6.1.2-31. Summary of Additive Impacts to Ground Transportation Resources with the Barrigada Cantonment/Family Housing (Alternative D) and any LFTRC

#	***Roadway Segments****	***Intersections***
1	Route 15, from Route 29 to Route 26 (SI)	Route 15 / Chalan Lajuna (SI)
2	Route 1, from Route 30 to Route 8 (SI)	Route 1 / Route 27 (SI)**
3	Route 1, from Route 6 (N) to Route 11 (SI)	Route 1 / Route 26 (SI)**
4	Route 8, from Route 10 to Route 33 (E) (SI)	Route 16 / Route 27 (SI)**
5	Route 8, from Route 33 (E) to Route 33 (W) (SI)	Route 15 / Route 26 (SI)
6	Route 8, from Route 33 (W) to Route 1 (SI)	Route 1 / Route 10A (SI)**
7	Route 10, from Route 8 to Route 15 (SI)	Route 8 / Chalan Santo Papa (SI)
8	Route 10, from Route 15 to Route 32 (SI)	Route 4 / Route 7B (SI)
9	Route 15, from Route 26 to Barrigada South Gate (SI)	NA
10	Route 15, from Barrigada South Gate to Route 10 (SI)	NA
11	Route 16, from Route 10A to Barrigada Main Gate (SI)	NA
12	Route 26, from Route 25 to Route 15 (SI)	NA
Total	**12, SI**	**8, SI**

Legend: NA indicates Not Applicable. SI indicates significant impact.
Notes: *Includes impacts to roadway segments in at least one direction during one (or both) weekday a.m. or p.m. peak hours.
** Indicates a significant but mitigable impact has been identified at this location under Year 2030 Alternative A.

Roadway Segment Operations. A capacity analysis was conducted to determine potential impacts to the off-base (external) roadway network during weekday a.m. and p.m. peak hours. The volume-to-capacity ratio and LOS for each study roadway segment is compared to the baseline conditions to determine if any significant impacts would occur. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

The addition of traffic generated by the proposed action would result in a potentially significant impact on 12 study roadway segments in at least one direction during the weekday a.m. and/or weekday p.m. peak hours.

- Route 15, from Route 26 to Route 29. This study roadway segment currently operates at acceptable LOS E with a v/c ratio of 0.96 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.08 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would continue to operate at LOS F with a v/c ratio of 1.17. The proposed action would increase traffic on this study roadway segment by approximately 63 vehicles during the weekday a.m. peak hour. This 7.5% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the southbound/westbound direction on this study roadway segment during the weekday p.m. peak hour.

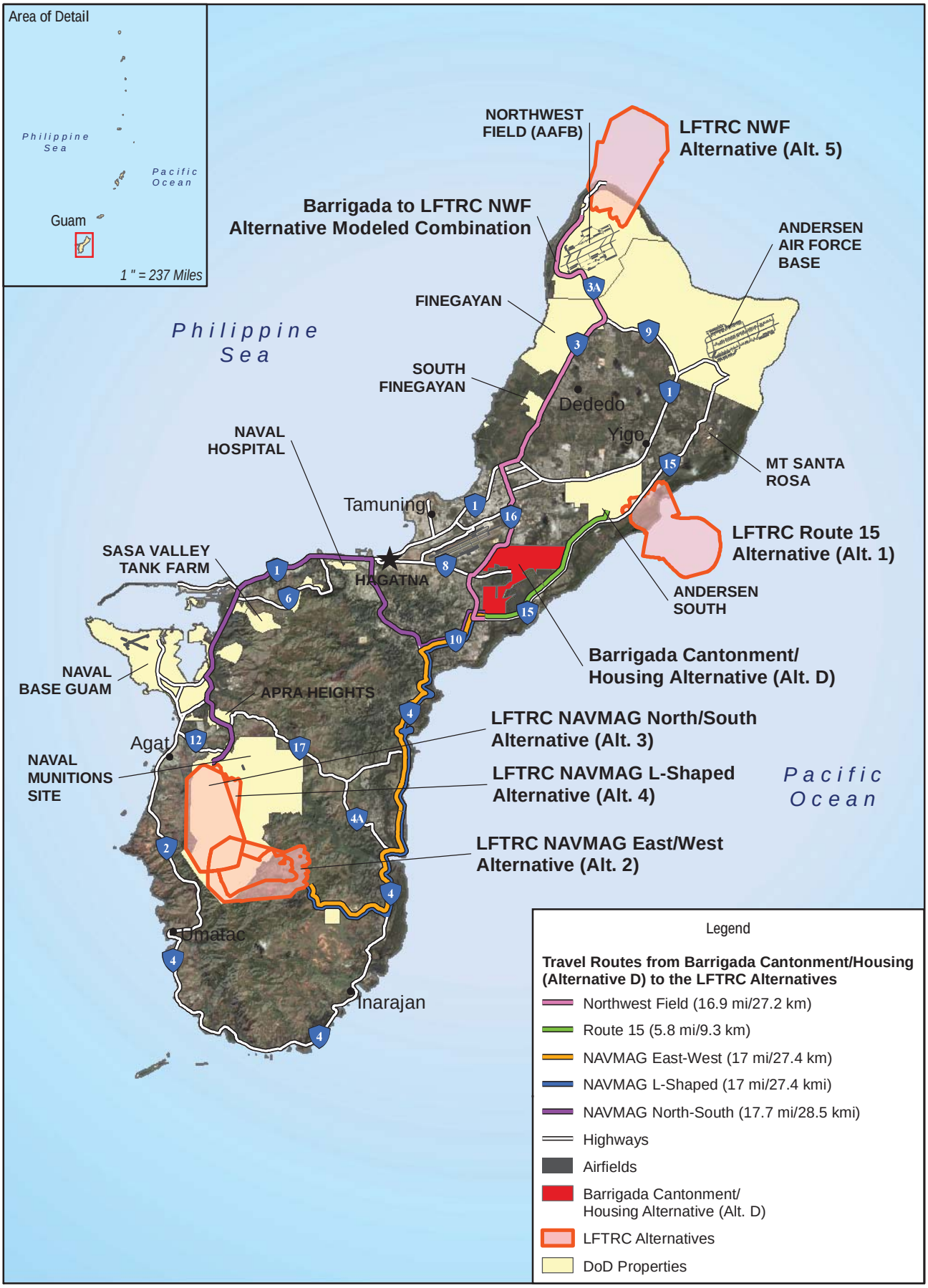


Figure 6.1.2-4
Travel Routes from Barrigada Cantonment/ Housing (Alternative D) to the LFTRC Alternatives

- Route 1, from Route 30 to Route 8. This study roadway segment currently operates at acceptable LOS E with a v/c ratio of 0.91 in the northbound/eastbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS E with a v/c ratio of 0.98 in the northbound/eastbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would degrade to unacceptable LOS F with a v/c ratio of 1.01. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday a.m. peak hour.
- Route 1, from Route 6 (N) to Route 11. This study roadway segment currently operates at LOS E with a v/c ratio of 0.99 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.05 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.11 in the southbound/westbound direction. The proposed action would increase traffic on this study roadway segment by approximately 95 vehicles during the weekday a.m. peak hour. This 5.4% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound direction during the weekday a.m. peak hour.
- Route 8, from Route 10 to Route 33 (E). This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.13 in the southbound/westbound direction under Existing Conditions. Traffic volumes would decrease and this study roadway segment would improve to operate at acceptable LOS E with a v/c ratio of 0.95 in the southbound/westbound during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would degrade to operate at LOS F with a v/c ratio of 1.07. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound directions during the weekday a.m. peak hour.
- Route 8, from Route 33 (E) to Route 33 (W). This study roadway segment currently operates at acceptable LOS D with a v/c ratio of 0.89 and unacceptable LOS F with a v/c ratio of 1.14 in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours, respectively. This study roadway segment would operate at acceptable LOS E with a v/c ratio of 0.98 and would continue to operate at unacceptable LOS F with a v/c ratio of 1.29 in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours, respectively under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would degrade to operate at unacceptable LOS F with a v/c ratio of 1.03 and would continue to operate at unacceptable LOS F with a v/c ratio of 1.38 in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours, respectively. The proposed action would increase traffic on this study roadway segment by approximately 148 vehicles during the weekday p.m. peak hour. This 6.7% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday a.m. and p.m. peak hours. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.13 and acceptable LOS C with a v/c ratio of 0.78 in the southbound/westbound

direction during the weekday a.m. and p.m. peak hours, respectively under Existing Conditions. This study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.16 and 1.03 in the southbound/westbound direction during the weekday a.m. and p.m. peak hours, respectively under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) this roadway segment would continue to operate at LOS F with a v/c ratio of 1.26 and 1.10 during the weekday a.m. and p.m. peak hours, respectively. The proposed action would increase traffic on this study roadway segment by approximately 162 and 114 vehicles during the weekday a.m. and p.m. peak hours, respectively. This 8.0% and 6.5% increase in traffic exceeds the 5.0% threshold of significance during the weekday a.m. and p.m. peak hours. Therefore, the proposed action would result in a significant impact on this study roadway segment in the northbound/eastbound and southbound/westbound directions during the weekday a.m. peak hour and p.m. peak hours.

- Route 8, from Route 1 to Route 33 (W). This study roadway segment currently operates at acceptable LOS D with a v/c ratio of 0.81 in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS E with a v/c ratio of 0.98 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would degrade to operate at unacceptable LOS F with a v/c ratio of 1.05. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday p.m. peak hour.
- Route 10, from Route 8 to Route 15. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.14 in the northbound/eastbound direction during the weekday a.m. peak hour and operates at acceptable LOS D with a v/c ratio of 0.89 in the southbound/westbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.26 in the northbound/eastbound direction during the weekday a.m. peak hour and a v/c ratio of 1.00 in the southbound/westbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.36 in the northbound/eastbound direction during the weekday a.m. peak hour and a v/c ratio of 1.13 in the southbound/westbound direction during the weekday p.m. peak hour. The proposed action would increase traffic on this study roadway segment by approximately 156 vehicles in the northbound/eastbound direction during the weekday a.m. peak hour and by 207 vehicles in the southbound/westbound direction during the weekday p.m. peak hour. This 7.2% increase in traffic in the northbound/eastbound during the weekday a.m. peak hour and 11.5% increase in traffic in the southbound/westbound directions during the weekday p.m. peak hour exceed the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact on this study roadway segment in the northbound/eastbound direction during the weekday a.m. peak hour and in the southbound/westbound direction during the weekday p.m. peak hour.
- Route 10, from Route 15 to Route 32. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.05 in the northbound/eastbound direction during the weekday a.m. peak hour and operates at acceptable LOS D with a v/c ratio of 0.85 in the southbound/westbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.17 in the northbound/eastbound direction during the weekday a.m. peak hour and at acceptable LOS E with

a v/c ratio of 0.96 in the southbound/westbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.23 in the northbound/eastbound direction during the weekday a.m. peak hour and would degrade to operate at unacceptable LOS F with a v/c ratio of 1.01 in the southbound/westbound direction during the weekday p.m. peak hour. The proposed action would increase traffic on this study roadway segment by approximately 97 vehicles in the northbound/eastbound direction during the weekday a.m. peak hour. This 5.1% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact on this study roadway segment in the northbound/eastbound direction during the weekday a.m. peak hour and in the southbound/westbound direction during the weekday p.m. peak hour.

- Route 15, from Route 26 to Barrigada South Gate. This study roadway segment currently operates at acceptable LOS D with a v/c ratio of 0.90 in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.06 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.24 in the northbound/eastbound direction during the weekday a.m. peak hour. The proposed action would increase traffic on this study roadway segment by approximately 131 vehicles in the northbound/eastbound direction during the weekday a.m. peak hour. This 14.7% increase in traffic exceeds the 5.0% threshold of significance. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.05 and acceptable LOS C with a v/c ratio of 0.76 in the southbound/westbound direction during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.11 and would operate at acceptable LOS D with a v/c ratio of 0.84 in the southbound/westbound direction during the weekday a.m. and p.m. peak hours, respectively, under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.28 and would degrade to operate at unacceptable LOS F during the weekday a.m. and p.m. peak hours, respectively, in the southbound/westbound direction. The proposed action would increase traffic on this study roadway segment by approximately 125 vehicles in the southbound/westbound direction during the weekday a.m. peak hour. This 13.5% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact on this study roadway segment in the northbound/eastbound direction during the weekday p.m. peak hour and in the southbound/westbound direction during the weekday a.m. and p.m. peak hours.
- Route 15, from Barrigada South Gate to Route 10. This study roadway segment currently operates at acceptable LOS A with a v/c ratio of 0.46 and acceptable LOS D with a v/c ratio of 0.90 in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This study roadway segment would continue to operate at acceptable LOS A with a v/c ratio of 0.60 and would operate at unacceptable LOS F with a v/c ratio of 1.02 in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours, respectively, under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would

degrade to operate at LOS F with a v/c ratio of 1.06 during the weekday a.m. peak hour and would continue to operate at unacceptable LOS F with a v/c ratio of 1.38 during the weekday p.m. peak hour in the northbound/eastbound direction. The proposed action would increase traffic on this study roadway segment by approximately 274 vehicles in the northbound/eastbound direction during the weekday p.m. peak hour. This 26.2% increase in traffic exceeds the 5.0% threshold of significance. This study roadway segment currently operates at acceptable LOS E with a v/c ratio of 0.93 and LOS B with a v/c ratio of 0.62 in the southbound/westbound direction during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.00 and at acceptable LOS C with a v/c ratio of 0.74 in the southbound/westbound direction during the weekday a.m. and p.m. peak hours, respectively, under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.25 and would degrade to operate at unacceptable LOS F with a v/c ratio of 1.22 during the weekday a.m. and p.m. peak hours, respectively, in the southbound/westbound direction. The proposed action would increase traffic on this study roadway segment by approximately 361 vehicles in the southbound/westbound direction during the weekday p.m. peak hour. This 39.2% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact on this study roadway segment in both directions during the weekday a.m. and p.m. peak hours.

- Route 16, from Route 10A to Barrigada Main Gate. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.03 and 1.09 in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.07 and 1.05 in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours, respectively, under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would continue to operate at LOS F with a v/c ratio of 1.16 and 1.10 during the weekday a.m. and p.m. peak hours. The proposed action would increase traffic on this study roadway segment by approximately 138 and 90 vehicles in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours, respectively. This 7.4% and 5.1% increase in traffic exceeds the 5.0% threshold of significance. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.01 and 1.09 in the southbound/westbound direction during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.13 in the southbound/westbound direction during the weekday p.m. peak hour, under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.24 during the weekday a.m. peak hour, in the southbound/westbound direction. The proposed action would increase traffic on this study roadway segment by approximately 165 vehicles in the southbound/westbound direction during the weekday p.m. peak hour. This 8.3% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact on this study roadway segment in the northbound/eastbound direction during the weekday a.m. and p.m. peak hours and in the southbound/westbound direction during the weekday p.m. peak hour.
- Route 26, from Route 25 to Route 15. This study roadway segment currently operates at acceptable LOS D with a v/c ratio of 0.84 in the northbound/eastbound direction during the

weekday p.m. peak hour, under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.01 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.08. The proposed action would increase traffic on this study roadway segment by approximately 47 vehicles in the northbound/eastbound direction during the weekday a.m. peak hour. This 6.1% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact on this study roadway segment in the northbound/eastbound direction during the weekday a.m. peak hour.

Although significant impacts would occur at all locations, potential mitigation measures have not been identified for any of the impacted roadway segments. Potential mitigation measures would be similar in scope and scale to those identified in Section 6.1.2.1. However, the exact details of the improvements would require further evaluations and technical studies to determine their feasibility. The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies, to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Intersection Operations. Intersection analysis was conducted to determine potential impacts to the off-base (external) intersections during weekday a.m. and p.m. peak hours. The LOS for each study intersection is compared to the baseline conditions to determine if any significant impacts would occur. An impact summary is provided in Table 6.1.2-31. The detailed results of the intersection analysis are provided in their entirety in Appendix F.

The addition of traffic generated by the proposed action would potentially result in a significant impact at eight study intersections during the weekday a.m. and/or weekday p.m. peak hours.

- Route 15 / Chalan Lajuna. This two-way stop-controlled study intersection currently operates at acceptable LOS D with 30.7 seconds of delay and acceptable LOS C with 23.9 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This study intersection would operate at unacceptable LOS F with 75.8 and 82.6 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. and p.m. peak hours. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours.
- Route 1 / Route 27. This signalized study intersection currently operates at acceptable LOS E with 70.3 seconds of delay during the weekday a.m. peak hour under Existing Conditions. This study intersection would operate at unacceptable LOS F with 118.3 seconds of delay during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study intersection would continue to operate at unacceptable LOS F with 134.1 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour.

- Route 1 / Route 26. This signalized study intersection currently operates at acceptable LOS C with 27.9 seconds of delay during the weekday p.m. peak hour under Existing Conditions. This intersection would operate at unacceptable LOS F with 87.6 seconds of delay during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study intersection would continue to operate at unacceptable LOS F with 94.9 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour.
- Route 16 / Route 27. This signalized study intersection currently operates at acceptable LOS C with 50.1 seconds of delay and acceptable LOS E with 71.2 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This intersection would operate at unacceptable LOS F with greater than 180.0 seconds of delay and 154.7 seconds of delay during the weekday a.m. and p.m. peak hours, respectively under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay and unacceptable LOS F with 165.9 seconds of delay during the weekday a.m. and p.m. peak hours, respectively. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours.
- Route 15 / Route 26. This two-way stop-controlled study intersection currently operates at unacceptable LOS F with 32.1 seconds of delay and 147.3 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This study intersection would operate at unacceptable LOS F with 145.2 seconds of delay and greater than 180.0 seconds of delay during the weekday a.m. and p.m. peak hours, respectively under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. and p.m. peak hours. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours.
- Route 1 / Route 10A. This signalized study intersection currently operates at acceptable LOS E with 62.6 seconds of delay during the weekday p.m. peak hour under Existing Conditions. This study intersection would operate at unacceptable LOS F with 139.3 seconds of delay during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study intersection would continue to operate at unacceptable LOS F with 143.2 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour.
- Route 8 / Chalan Santo Papa. This two-way stop-controlled study intersection currently operates at unacceptable LOS F with 55.1 seconds of delay and 53.0 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This study intersection would continue to operate at unacceptable LOS F with 86.5 seconds of delay and 158.9 seconds of delay during the weekday a.m. and p.m. peak hours, respectively under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study intersection would continue to operate at unacceptable LOS F with 127.7 seconds of delay and greater than 180.0 seconds of delay during the weekday a.m. and p.m. peak hours, respectively.

The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours.

- Route 4 / Route 7B. This signalized study intersection currently operates at acceptable LOS E with 45.7 seconds of delay during the weekday p.m. peak hour under Existing Conditions. This study intersection would operate at unacceptable LOS F with 161.3 seconds of delay during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Barrigada Cantonment/Family Housing (Alternative D) Conditions, this study intersection would continue to operate at unacceptable LOS F with 171.6 seconds of delay during the weekday p.m. peak hour. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour.

Although significant impacts would occur at all locations, potential mitigation measures have not been identified for any of the impacted roadway segments or intersections. Potential mitigation measures would be similar in scope and scale to those identified in Section 6.1.2.1. However, the exact details of the improvements would require further evaluations and technical studies to determine their feasibility. Potential. The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies, to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Transit Conditions. There would be no impacts to transit conditions under Alternative D with Alternative 1.

Pedestrian and Bicycle Conditions. There would be no impacts to pedestrian and bicycle conditions under Alternative D with Alternative 1.

Public Health and Safety

The potential for traffic incidents is the primary health and safety issue with potential for having additive impacts from implementing a specific cantonment/family housing alternative with a specific LFTRC alternative. The driving distance between the proposed Barrigada Cantonment/Family Housing (Alternative D) area and Alternative 1 is approximately 5.8 miles. Vehicles would use Routes 8, 10 and 15 to commute between the Alternative D area and Alternative 1.

One high-crash frequency intersection (intersection of Routes 8/10/16) is situated along the travel route between the Alternative D area and Alternative 1. This intersection is in the central portion of Guam and must be driven through when arriving/leaving the Barrigada Main Gate because Route 8 provides direct access to the Alternative D area. The travel distance between the Alternative D area and Alternative 1 is relatively short however, with this one high-frequency crash intersection situated along the travel route resulting in a higher potential for being involved in a traffic incident or to be delayed because of traffic incidents. Because the travel distance is short, a less-than-significant additive impact on traffic would occur.

6.1.2.8 Barrigada Cantonment/Family Housing Alternative D with any NAVMAG LFTRC Alternative (Alternatives 2, 3, or 4)

Air Quality

The combined air quality impacts would be similar to those described in Section 6.1.2.1. The combined construction island-wide emissions, summarized in Section 6.1.2.7 and Table 6.1.2-28, would be less than significant as a result of these combined alternatives.

Terrestrial Biological Resources

Barrigada Cantonment/Family Housing Alternative D with NAVMAG (East/West) LFTRC Alternative 2

The additive impacts of implementing Cantonment/Family Housing Alternative D, LFTRC Alternative 2, and the IT/COMM infrastructure are provided in Table 6.1.2-32. Overall, approximately 282 acres (114 ha) of limestone forest, or 1% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 126 acres (51 ha) of Overlay Refuge lands, or <1% of the total Overlay Refuge currently present on Guam, would be disturbed. In regards to recovery habitat for ESA-listed species, the greatest impact would be to Guam rail recovery habitat with 1,057 acres (428 ha) developed, mostly associated with Alternative D. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-32. Summary of Impacts to Terrestrial Biological Resources with Implementation of Barrigada Cantonment/Family Housing (Alternative D), NAVMAG (East/West) LFTRC (Alternative 2), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative D	99 (40)	133 (54)	48 (19)	GR	-	MFB: 48 (19) MC: 48 (19) GR: 864 (350) GMK: 48 (19) Ser: 41 (17)
Alternative 2	0	19 (8)	0	-	-	MFB: 43 (17) MC: 43 (17) GR: 49 (20) GMK: 43 (17) Ser: 18 (7)
IT/COMM	6 (2)	25 (10)	78 (32)	-	-	MFB: 50 (20) MC: 50 (20) GR: 144 (58) GMK: 50 (20) Ser: 42 (17)
Total	**105 (42)**	**177 (72)**	**126 (51)**	-	-	**MFB: 141 (57)** **MC: 141 (57)** **GR: 1,057 (428)** **GMK: 141 (57)** **Ser: 104 (42)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, Ser = *Serianthes*.

Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Barrigada Cantonment/Family Housing Alternative D with NAVMAG (North/South) LFTRC Alternative 3

The additive impacts of implementing Cantonment/Family Housing Alternative D, LFTRC Alternative 3, and the IT/COMM infrastructure are provided in Table 6.1.2-33. Overall, approximately 432 acres (175 ha) of limestone forest, or 2% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 401 acres (162 ha) of Overlay Refuge lands, or 2% of the total Overlay Refuge currently present on Guam, would be disturbed. In regards to recovery habitat for ESA-listed species, the greatest impact would be to Guam rail recovery habitat with 1,032 acres (418 ha) developed, mostly associated with Alternative D. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-33. Summary of Impacts to Terrestrial Biological Resources with Implementation of Barrigada Cantonment/Family Housing (Alternative D), NAVMAG (North/South) LFTRC (Alternative 3), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative D	99 (40)	133 (54)	48 (19)	GR	-	MFB: 48 (19) MC: 48 (19) GR: 864 (350) GMK: 48 (19) Ser: 41 (17)
Alternative 3	105 (42)	64 (26)	275 (111)	MFB, MC, GMK, MCM	PSTG	MFB: 223 (90) MC: 230 (93) GR: 24 (10) GMK: 223 (90) Ser: 40 (16)
IT/COMM	6 (2)	25 (10)	78 (32)	-	-	MFB: 50 (20) MC: 50 (20) GR: 144 (58) GMK: 50 (20) Ser: 42 (17)
Total	**210 (85)**	**222 (90)**	**401 (162)**	-	-	**MFB: 321 (130)** **MC: 328 (133)** **GR: 1,032 (418)** **GMK: 321 (130)** **Ser: 123 (50)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Barrigada Cantonment/Family Housing Alternative D with NAVMAG (L-Shaped) LFTRC Alternative 4

The additive impacts of implementing Cantonment/Family Housing Alternative D, LFTRC Alternative 4, and the IT/COMM infrastructure are provided in Table 6.1.2-34. Overall, 393 acres (159 ha) of limestone forest, or 2% of the total limestone forest currently present on Guam, would be disturbed. In addition, 345 acres (140 ha) of Overlay Refuge lands, or 1% of the total Overlay Refuge currently present on Guam, would be disturbed. In regards to recovery habitat for ESA-listed species, the greatest impact would be to Guam rail recovery habitat with 1,058 acres (428 ha) developed, mostly associated with Alternative D. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-34. Summary of Impacts to Terrestrial Biological Resources with Implementation of Barrigada Cantonment/Family Housing (Alternative D), NAVMAG (L-Shaped) LFTRC (Alternative 4), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species(2)*	*Recovery Habitat (acres [ha])*
Alternative D	99 (40)	133 (54)	48 (19)	GR	-	MFB: 48 (19) MC: 48 (19) GR: 864 (350) GMK: 48 (19) Ser: 41 (17)
Alternative 4	67 (27)	63 (26)	219 (88)	MFB, MC, GMK	PSTG	MFB: 161 (65) MC: 166 (67) GR: 50 (20) GMK: 161 (65) Ser: 19 (8)
IT/COMM	6 (2)	25 (10)	78 (32)	-	-	MFB: 50 (20) MC: 50 (20) GR: 144 (58) GMK: 50 (20) Ser: 42 (17)
Total	**172 (70)**	**221 (90)**	**345 (140)**	-	-	**MFB: 259 (105)** **MC: 264 (107)** **GR: 1.058 (428)** **GMK: 259 (105)** **Ser: 102 (41)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crown, MFB = Mariana fruit bat, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Cultural Resources

Adverse effects to historic properties under NHPA and impacts to other cultural resources of cultural importance resulting from the implementation of Alternative D and Alternatives 2, 3, or 4 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. Construction for the IT/COMM lines for Alternative D and Alternatives 2, 3, or 4 would occur along Routes 1, 2A, 3, 3A, 4, 4A, 5, 8, 9, 10, 15, 16, and 17. In general, IT/COMM lines would follow existing roads; however, additional lines would be constructed at AAFB and from AAFB to Finegayan. Approximately 52% of these areas have been previously surveyed (Thomas and Price 1979; Davis 1983; April 1984; Kurashina *et al.* 1987; Amesbury and Moore 1989; Moore and Amesbury 1989; Highness and Haun 1990; Amesbury *et al.* 1991; Carrell 1991, Russell and Guerrero 1991; Prasad and Moore 1992; Russell *et al.* 1993; Henry *et al.* 1994, 1996, 1999; Hunter-Anderson 1994; Reinman 1995; Wells *et al.* 1995; Workman and Haun 1995; Liston 1996; Hunter-Anderson *et al.* 1995, 1997; Reinman and Nees 1998; Hunter-Anderson *et al.* 2001; Allen *et al.* 2002; Olmo *et al.* 2002; Hunter-Anderson 2002, 2004; Hunter-Anderson and Moore 2002, 2003; Dixon *et al.* 1999, 2004, 2011a, 2011b, 2015a, 2015b; Yee *et al.* 2004; DeFant and Guerrero 2006; Grant *et al.* 2007; Church *et al.* 2009; Athens, 2009; Welch 2010; Dixon and Walker 2011; DeFant 2013). As not all of the routes have been surveyed, a literature review of previous surveys and sites located within the construction corridor was undertaken and the likelihood of finding buried cultural resources within PDIA for the IT/COMM lines corridor was assessed based on the level of disturbance, the proximity of known sites, and historic land use (Dixon *et al.* 2014). Within the PDIA for

the IT/COMM lines, approximately 55% of Route 1, 61% of Route 2A, 100% of Route 3, 67% of Route 3A, 11% of Route 4, 100% of Route 4A, 16% of Route 5, 2% of Route 8, 70% of Route 9, 1% of Route 10, 72% of Route 15, 50% of Route 16, and 2% of Route 17 have been surveyed.

Table 6.1.2-35 lists 15 known archaeological sites within the IT/COMM lines PDIA for Alternatives 2, 3, and 4. Four of the sites, including remnants of an historic encampment, two Latte Period artifact scatters, and portions of NWF, are eligible for listing in the NRHP. Eleven archaeological sites are not eligible for listing in the NRHP. The literature review indicated that there are also areas that were not previously surveyed that have potential for buried cultural resources along Routes 1, 5, 15, and 17.

Table 6.1.2-35. Archaeological Sites within IT/COMM Lines Potential Impacted Area for Barrigada Cantonment/Family Housing (Alternative D) and LFTRC (Alternatives 2, 3, or 4)

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
	36*	Flagpole	Post-WWII/Second American Territorial	Lauter-Reinman 1997	No	NA
	377*	Ceramic Scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
	1066*	Concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-07-2119	1001*	Artifact Scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle Dump	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact Scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2321	T-11/1046*	Ceramic/ Artifact Scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-0213	T-16	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
66-08-1065***		Airfield	Post-WWII/Second American Territorial	Aaron *et al.* 2007	Yes	A
66-08-2305	ANT-6/1028	Encampment	Post-WWII/Second American Territorial	Welch 2010	Yes	D
66-08-2308***	ANT-10/1034	Artifact Scatter	Pre-Contact/Latte	Welch 2010	Yes	D
	T-A4S-5	Concrete Pads	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
	T-H-1	Artifact scatter & concrete foundations	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/Latte; WWII Japanese Military Occupation, Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

*From Welch (2009) (Map no. 36, 235, 377, 493) and Welch (2010) (Map no. 1066).

**Revised to match Guam GHPI forms dated May 28, 2014.

***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

One structure eligible for listing in the NRHP, North Field, is located within the potential impacted area for Alternatives 2, 3, and 4. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

The installation of IT/COMM links between Alternative D and the LFTRC Alternatives 2, 3, or 4 has the potential to result in adverse effects from excavation and soil removal to five historic properties, including four NRHP-eligible archaeological sites (see Table 6.1.2-35) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be directly affected by the construction of the IT/COMM links.

No direct or indirect adverse effects due to operation of the IT/COMM utilities would occur as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

Alternative D was modeled with Alternative 5 (Section 3.12.1). Pairing Alternative D with Alternative 2, 3, or 4 may result in a slight increase (less than 5%) in vehicles on roadway segments and at intersections that comprise the most direct route between the Alternative D Main Gate and the Alternative 2, 3, or 4 gates, as well as a slight decrease in vehicles on roadway segments and at intersections that comprise the most direct route between the modeled combination Alternative D Main Gate and the Alternative 5 gate (see Figure 6.1.2-4). This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route.

Although significant impacts would occur at all locations, potential mitigation measures have not been identified for any of the impacted roadway segments or intersections. Potential mitigation measures would be similar in scope and scale to those identified in Section 6.1.2.1. However, the exact details of the improvements would require further evaluations and technical studies to determine their feasibility. The final list of implementable mitigation measures will be dependent on the selected alternative, or combination of alternatives and based on project-level technical studies to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Roadway Segment Operations. Impacts to all off-base (external) roadway segments would be the same as those identified in Section 6.1.2.7. Significant impacts were identified on 12 roadway segments. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

Intersection Operations. Impacts to all intersections would be the same as those identified in Section 6.1.2.7 (see Table 6.1.2-31). Significant impacts were identified at eight intersections. The detailed results of the intersection analysis are provided in its entirety in Appendix F.

Transit Conditions. Transit conditions under Alternative D with Alternative 2, 3, or 4 would be similar to those described in Section 6.1.2.7 for Alternative D with Alternative 1.

Pedestrian and Bicycle Conditions. Pedestrian and bicycle conditions under Alternative D with Alternative 2, 3, or 4 would be similar to those described in Section 6.1.2.7 for Alternative D with Alternative 1.

Public Health and Safety

The potential for traffic incidents is the primary health and safety issue with potential for having additive impacts from implementing a specific cantonment/family housing alternative with a specific LFTRC alternative. The driving distance between the Alternative D area and Alternatives 2, 3, and 4 is approximately 18 miles (29 km) to Alternative 2, and approximately 17 miles (27 km) to Alternatives 3 and 4. Vehicles would use Routes 1, 8, and 10 to commute between the Alternative D area and Alternative 2, while Routes 4, 8, and 10, as well as a new roadway in Dandan, would be used to access Alternatives 3 and 4.

One high-crash frequency intersection (intersection of Routes 8/10/16) is situated along the travel route between the Alternative D area and Alternatives 2, 3, and 4. This intersection is in the central portion of Guam, and because Route 8 provides direct access to the Alternative D area, this intersection must be driven through when arriving/leaving the Barrigada Main Gate. The travel distance between the Alternative D area and Alternatives 2, 3, and 4 is relatively long, with one high-frequency crash intersection situated along the travel route, resulting in a higher potential for being involved in a traffic incident or to be delayed because of traffic incidents. However, a less than significant additive impact on traffic would occur.

6.1.2.9 Barrigada Cantonment/Family Housing Alternative D with NWF LFTRC Alternative 5

Air Quality

The combined air quality impacts would be similar to those described in Section 6.1.2.1.

The combined construction island-wide emissions, summarized in Section 6.1.2.7 and Table 6.1.2-28, would be less than significant as a result of these combined alternatives.

Terrestrial Biological Resources

The additive impacts of implementing Cantonment/Family Housing Alternative D, LFTRC Alternative 5, and the IT/COMM infrastructure are provided in Table 6.1.2-36. Overall, 482 acres (195 ha) of limestone forest, or 2% of the total limestone forest currently present on Guam, would be disturbed. In addition, 424 acres (172 ha) of Overlay Refuge lands, or 2% of the total Overlay Refuge currently present on Guam, would be disturbed. In regards to recovery habitat for ESA-listed species, the greatest impact would be to Guam rail recovery habitat with 1,090 acres (441 ha) developed, mostly associated with Alternative D. The proposed IT/COMM alignment contributes little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-36. Summary of Impacts to Terrestrial Biological Resources with Implementation of Barrigada Cantonment/Family Housing (Alternative D), NWF LFTRC (Alternative 5), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*	*Critical Habitat (acres [ha])*
Alternative D	99 (40)	133 (54)	48 (19)	GR	-	MFB: 48 (19) MC: 48 (19) GR: 864 (350) GMK: 48 (19) Ser: 41 (17)	NA
Alternative 5	89 (36)	130 (53)	298 (121)	MFB, MC, GMK, Ser	-	MFB: 215 (87) MC: 215 (87) GR: 82 (33) GMK: 215 (87) Ser: 177 (71)	MFB, MC, GMK: 11 (5)
IT/COMM	6 (2)	25 (10)	78 (32)	-	-	MFB: 50 (20) MC: 50 (20) GR: 144 (58) GMK: 50 (20) Ser: 42 (17)	NA
Total	**194 (78)**	**288 (117)**	**424 (172)**			**MFB: 313 (127) MC: 313 (127) GR: 1,090 (441) GMK: 313 (127) Ser: 260 (105)**	

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crown, MFB = Mariana fruit bat, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Cultural Resources

Adverse effects to historic properties under NHPA and impacts to other cultural resources of cultural importance resulting from the implementation of Alternatives D and 5 would be equal to the combined effects and impacts of each as discussed in Chapters 4 and 5. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives. Construction for the IT/COMM lines for Alternative D and Alternative 5 would occur along Routes 1, 2A, 3, 3A, 4, 4A, 5, 8, 9, 10, 15, 16, and 17. In general, IT/COMM lines would follow existing roads; however, additional lines would be constructed at AAFB and from AAFB to Finegayan. Approximately 49% of these areas have been previously surveyed (Davis 1983; April 1984; Kurashina *et al.* 1988; Amesbury and Moore 1989; Moore and Amesbury 1989; Highness and Haun 1990; Russell and Guerrero 1991; Henry *et al.* 1996, 1999; Hunter-Anderson 1994; Liston 1996; Reinman and Nees 1998; Olmo *et al.* 2000; Allen *et al.* 2002; Hunter-Anderson 2002; Hunter-Anderson and Moore 2002, 2003; Dixon *et al.* 2004, 2011a, 2011b, 2015a, 2015b; Yee *et al.* 2004; DeFant and Guerrero 2006; Grant *et al.* 2007; Church *et al.* 2009; Athens, 2009; Welch 2010; Dixon and Walker 2011; DeFant 2013). As not all of the routes have been surveyed, a literature review of previous surveys and sites located within the construction corridor was undertaken and the likelihood of finding buried cultural resources within PDIA for the IT/COMM lines corridor was assessed based on the level of disturbance, the proximity of known sites, and historic land use (Dixon *et al.* 2014). Within the PDIA for the IT/COMM lines, approximately 12% of Route 1, 57% of Route 2A, 100% of Route 3, 100% of Route 3A, 4% of Route 4, 100% of Route 4A, 16% of Route 5, none of Route

8, 70% of Route 9, 1% of Route 10, 72% of Route 15, 50% of Route 16, and 2% of Route 17 have been surveyed.

Table 6.1.2-37 lists 13 known archaeological sites within the IT/COMM lines PDIA. Four of the sites, including two Latte Period artifact scatters, an historic encampment, and portions of NWF, are eligible to the NRHP. Nine archaeological sites are not eligible for listing in the NRHP. The literature review indicated that there are also areas that were not previously surveyed that have potential for buried cultural resources along Routes 1, 5, 15, and 17.

Table 6.1.2-37. Archaeological Sites within the IT/COMM Lines Potential Impacted Area for Barrigada Cantonment Housing (Alternative D) and the NWF LFTRC (Alternative 5)

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
	36*	Flagpole stand	Post-WWII/Second American Territorial	Lauter-Reinman 1997	No	NA
	1066*	Concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	D
66-07-2119	1001*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle dump	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2321	T-11/1046*	Ceramic/ artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-1065***		Airfield	Post-WWII/Second American Territorial	Aaron *et al.* 2007	Yes	A
66-08-2305	ANT-6/1028	Encampment	Post-WWII/Second American Territorial	Welch 2010	Yes	D
66-08-2308***	ANT-10/1034	Artifact Scatter	Pre-Contact/Latte	Welch 2010	Yes	D
	T-A4S-5	Concrete pads	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
	T-H-1	Artifact scatter & concrete foundations	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/Latte, Japanese Military Occupation, Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history.

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

*From Welch (2009) (Map no. 36, 377, 493) and Welch (2010) (Map no. 1066).

**Revised to match Guam GHPI forms dated May 28, 2014.

***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

One structure eligible for listing in the NRHP, North Field, is located within the potential impacted area. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

The installation of IT/COMM links between Alternative D and the LFTRC Alternative 5 has the potential to result in adverse effects from excavation and soil removal to five historic properties—four NRHP-eligible archaeological sites (see Table 6.1.2-37), and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be directly affected by the construction of the IT/COMM links.

No direct or indirect adverse effects due to operation of the IT/COMM utilities would occur as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

Alternative D was modeled with Alternative 5 (Section 3.12.1). Although significant impacts would occur at all locations, potential mitigation measures have not been identified for any of the impacted roadway segments or intersections. Potential mitigation measures would be similar in scope and scale to those identified in Section 6.1.2.1. However, the exact details of the improvements would require further evaluations and technical studies to determine their feasibility. The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies, to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Roadway Segment Operations. Impacts to all off-base (external) roadway segments would be the same as those identified in Section 6.1.2.7. Significant impacts were identified on 12 roadway segments. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

Intersection Operations. Impacts to all intersections would be the same as those identified in Section 6.1.2.7 (Table 6.1.2-31). Significant impacts were identified at eight intersections. The detailed results of the intersection analysis are provided in its entirety in Appendix F.

Transit Conditions. Transit conditions under Alternative D with Alternative 5 would be similar to those described in Section 6.1.2.7 for Alternative D with Alternative 1.

Pedestrian and Bicycle Conditions. Pedestrian and bicycle conditions under Alternative D with Alternative 5 would be similar to those described in Section 6.1.2.7 for Alternative D with Alternative 1.

Public Health and Safety

The potential for traffic incidents is the primary health and safety issue with potential for having additive impacts from implementing a specific cantonment/family housing alternative with a specific LFTRC alternative. The driving distance between the Alternative D area and Alternative 5 is approximately 16.9 miles. Vehicles would use Routes 1, 3, 3A, 8, and 16 to commute between the Alternative D area and Alternative 5.

Two high-crash frequency intersections (intersection of Routes 8/10/16 and Routes 1/3) are situated along the travel route between the Alternative D area and Alternative 5. In an effort to improve vehicle safety at the intersection of Routes 8/10/16, traffic improvements were completed in 2012 that includes the installation of a new traffic signal system that reduced congestion and channelized traffic. These intersections are in the central portion of Guam and because Route 8 provides direct access to the Alternative D area, that intersection must be driven through when arriving/leaving the Barrigada Main Gate. The travel distance between the Alternative D area and Alternative 5 is relatively long, with the two high-frequency crash intersections situated along the travel route resulting in a higher potential for being involved in a traffic incident or to be delayed because of traffic incidents. However, a less-than-significant additive impact on traffic would occur.

6.1.2.10 Finegayan Cantonment/AAFB Family Housing (Alternative E) with Route 15 LFTRC (Alternative 1)

Air Quality

The combined air quality impacts would be the same as those described in Section 6.1.2.1. The combined construction island-wide emissions impacts, summarized in Table 6.1.2-1, would be less than significant as a result of this combined alternative.

Terrestrial Biological Resources

The additive impacts of implementing cantonment/family housing Alternative E with LFTRC Alternative 1 and the IT/COMM infrastructure are provided in Table 6.1.2-38. Overall, approximately 1,063 acres (430 ha) of limestone forest, or 6% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,148 acres (465 ha) of Overlay Refuge lands, or 5% of the total Overlay Refuge currently present on Guam, would be disturbed. The majority (73%) of the impacts to terrestrial biological resources would occur under Alternative E, with 780 acres (316 ha) of limestone forest disturbed. The proposed IT/COMM alignment contributes very little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-38. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan Cantonment/AAFB Family Housing (Alternative) E with Route 15 LFTRC (Alternative 1), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative E	2 (0.8)	778 (315)	1,065 (431)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 719 (291) MC: 719 (291) GR: 507 (205) GMK: 719 (291) Ser: 648 (262)
Alternative 1	65 (26)	190 (77)	NA	GR	-	MFB: 81 (33) MC: 81 (33) GR: 283 (115) GMK: 81 (33) Ser: 67 (27)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**71 (29)**	**992 (401)**	**1,148 (465)**	-	-	**MFB: 836 (338)** **MC: 837 (339)** **GR: 927 (375)** **GMK: 836 (338)** **Ser: 745 (301)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Cultural Resources

Adverse effects to historic properties and impacts to other cultural resources of cultural importance resulting from the implementation of Alternatives E and 1 would be similar to the combined effects and impacts of Finegayan Cantonment/Family Housing Alternative A with Route 15 LFTRC Alternative 1 discussed in Section 6.1.2.1. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives.

Table 6.1.2-39 lists 11 known archaeological sites within the IT/COMM lines PDIA. One of the sites, including portions of NWF, is eligible for listing in the NRHP. Ten archaeological sites are not eligible for listing in the NRHP. A literature review indicated that there are also areas that were not previously surveyed that have a potential for buried cultural resources along Routes 1, 4, 5, 15, and 17.

Table 6.1.2-39. Archaeological Sites within the IT/COMM Lines Potential Impacted Area for Finegayan Cantonment/AAFB Family Housing (Alternative E) and Route 15 LFTRC (Alternative 1)

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period*	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-07-0213	T-16	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
66-07-2119	1001*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle dump	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-08-1065**		Airfield	Post-WWII/Second American Territorial	Aaron *et al.* 2007	Yes	A
	36*	Flagpole	Post-WWII/Second American Territorial	Lauter-Reinman 1997	No	NA
	377*	Ceramic Scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
	1066*	Concrete pads, roads, other remains	Post-WWII/ Second American Territorial	Welch 2010	No	NA
	T-A4S-5	Concrete pads	Post-WWII/ Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/Latte; WWII Japanese Military Occupation/Second American Territorial	Dixon *et al.* 2014	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

*Map Numbers from Welch (2009) and Welch (2010).

**The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

One structure eligible for listing in the NRHP, North Field, is located within the potential impacted area. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

The installation of IT/COMM links between Alternative E and the LFTRC Alternative 1 has the potential to cause adverse effects from excavation and soil removal to two historic properties, including one NRHP-eligible archaeological sites (see Table 6.1.2-39) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be directly affected by the construction of the IT/COMM links.

No direct or indirect adverse effects are anticipated to occur due to operation of the IT/COMM utilities as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

The travel demand modeling methodology for the combination of alternatives was defined and directed by the DoD and the FHWA to provide detailed off-base (external) roadway and intersection analysis for one representative pairing (the modeled combination) of each cantonment/family housing alternative with one of the LFTRC site alternatives.

The modeled combination for Cantonment/Family Housing Alternative E included a pairing with LFTRC Alternative 5 (see Section 3.12). Although Alternative 5 was used for the modeled combination, the results allowed for a thorough qualitative assessment of impacts associated with the other cantonment/ family housing and LFTRC alternative combinations as well. Modeling results for this scenario indicate that weekday a.m. peak hour vehicle traffic related to the proposed action is generated solely by operations at the cantonment/family housing area. LFTRC-related traffic would occur prior to the start of weekday a.m. peak hour (8:00 a.m.) and may coincide with the weekday p.m. peak hour (4:30 p.m. to 5:30 p.m.) (see Section 5.1.12). Operations of the LFTRC would increase traffic on the off-base (external) roadway segments and intersections that comprise the most direct route between the main cantonment gate and the LFTRC gates by approximately 38 vehicles (measured in passenger car equivalents) (see Table 5.1.12-2 in Chapter 5). LFTRC-related traffic represents an insubstantial amount of traffic (less than 5%) along the route. This minimal incremental increase in traffic volumes would not adversely affect LOS on roadways or at intersections along the route. The relative contribution from LFTRC traffic to the off-base (external) roadway segment and intersection impacts of each cantonment/family housing alternative would be minimal and would not vary appreciably with any LFTRC pairing (Alternative 1, 2, 3, 4, or 5). Therefore, the impacts to off-base (external) roadway segments and intersections would be essentially the same for Alternative E with Alternative 1, Alternative E with Alternative 2, 3, or 4, and Alternative E with Alternative 5. A qualitative discussion of the potential effects of LFTRC-related traffic is provided for each combination.

Travel routes from Finegayan Cantonment / AAFB Housing (Alternative E) to the LFTRC Alternatives are shown in Figure 6.1.2-5 and would be the same as for Alternative A as shown in Figure 6.1.2-1. Pairing Alternative E with Alternative 1 may result in a slight increase in vehicles (less than 5%) on roadway segments and at intersections that comprise the most direct route between the Alternative E Main Gate and the Alternative 1 gate, and a slight decrease in vehicles compared to the modeled combination Alternative E Main Gate and the Alternative 5 gate (see Figure 6.1.2-1). This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route.

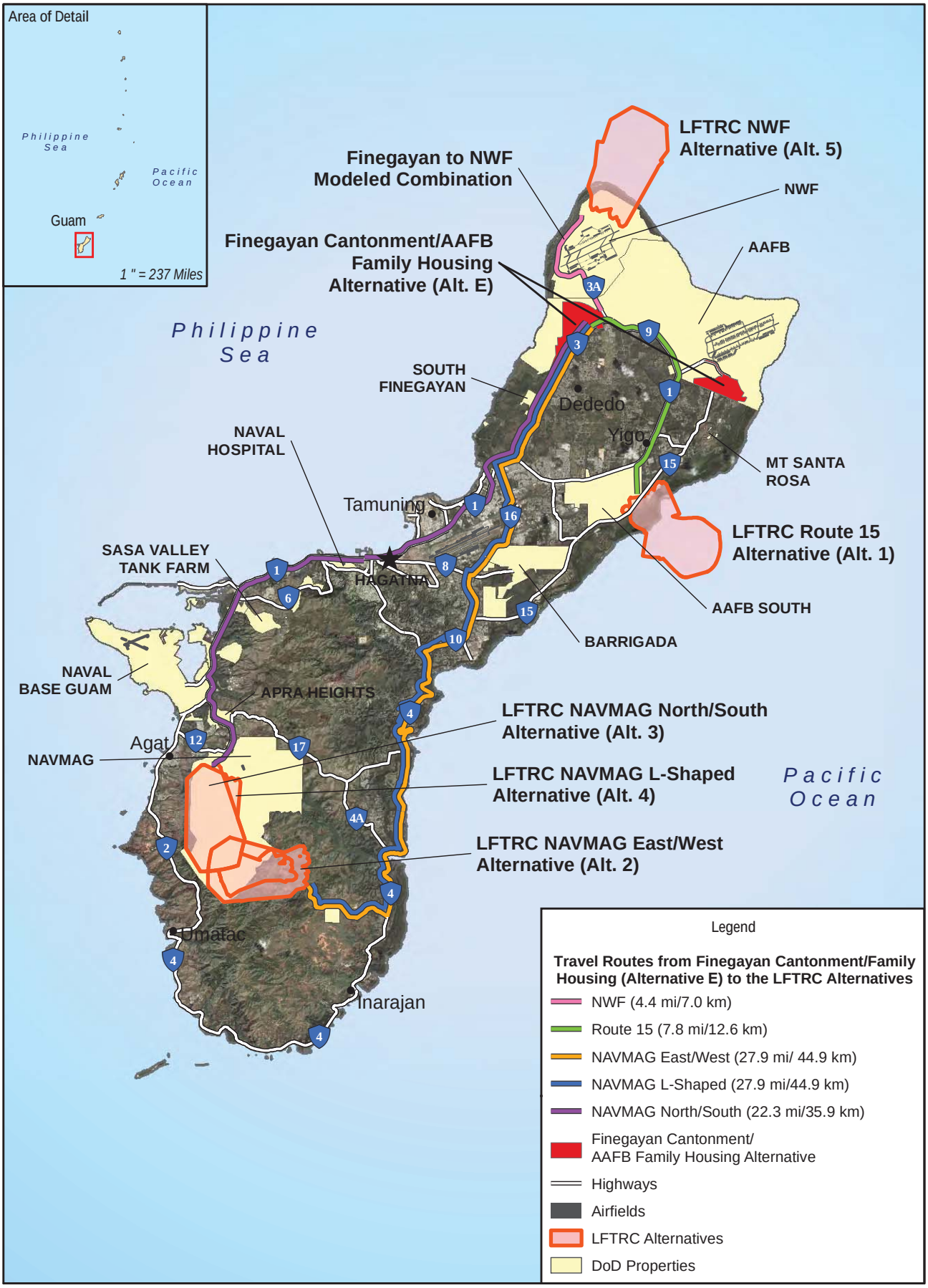


Figure 6.1.2-5
Travel Routes from Finegayan Cantonment/AAFB Housing (Alternative E) to the LFTRC Alternatives

The combined impacts to off-base (external) roadway segments and intersections are summarized in Table 6.1.2-40.

Table 6.1.2-40. Summary of Additive Impacts to Ground Transportation Resources with the Finegayan Cantonment/AAFB Family Housing (Alternative E) and any LFTRC Alternative

#	*Roadway Segments**	*Intersections*
1	Route 1, from Route 3 to Route 34 (SI-M)	Route 3 / Route 3A (SI-M)**
2	Route 1, from Route 34 to Route 16 (SI-M)	Route 3 / 9 / Chalan Santa Anita (SI-M)
3	Route 3, from Route 3A/9 to Finegayan Main Gate (SI-M)	Route 3 / Royal Palm Drive (SI-M)
4	Route 3, from Finegayan Main Gate To Finegayan Residential Gate (SI-M)	Route 1 / Route 3 (SI-M)
5	Route 3, from Finegayan Residential Gate To Route 28 (SI-M)	Route 1 / Route 27 (SI-M)
6	Route 3, from Route 28 To South Finegayan Main Gate (SI-M)	Route 1 / Route 26 (SI-M)
7	Route 3, from South Finegayan Main Gate To Route 1 (SI-M)	Route 16 / Route 27 (SI-M)
8	Route 28, from Chalan Balako to Route 3 (SI-M)	Route 16 / Route 10A (SI-M)
9	NA	Route 1 / Route 14A (SI-M)
10	NA	Route 1 / Route 10A (SI-M)
Total	**8, SI-M**	**10, SI-M**

Legend: NA = not applicable, SI-M = significant but may be mitigated impact.
Notes: *Includes impacts to roadway segments in at least one direction during one (or both) weekday a.m. or p.m. peak hours.
** Indicates an impact that would not occur under Year 2030 Alternative A Conditions.

Roadway Segment Operations

A capacity analysis was conducted to determine potential impacts to the off-base (external) roadway network during weekday a.m. and p.m. peak hours. The v/c ratio and LOS for each study roadway segment was compared to the baseline conditions to determine if any significant impacts would occur. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

The addition of traffic generated by the proposed action would result in a potentially significant impact on eight study roadway segments in at least one direction during the weekday a.m. and/or weekday p.m. peak hours:

- Route 1, from Route 3 to Route 34. This study roadway segment currently operates at acceptable LOS E with a v/c ratio of 0.99 in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.01 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative E Conditions, this study roadway segment would continue to operate at LOS F with a v/c ratio of 1.06. The proposed action would increase traffic on this study roadway segment by approximately 130 vehicles during the weekday p.m. peak hour. This 5.1% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday p.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.

- Route 1, from Route 34 to Route 16. This study roadway segment currently operates at acceptable LOS E with a v/c ratio of 0.96 in the in the northbound/eastbound direction during the weekday p.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS E with a v/c ratio of 0.97 in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative E Conditions, this study roadway segment would degrade to unacceptable LOS F with a v/c ratio of 1.03. Therefore, the proposed action would result in a significant impact in the northbound/eastbound direction on this study roadway segment during the weekday p.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.
- Route 3, from Route 3A/9 to Finegayan Main Gate. This study roadway segment currently operates at acceptable LOS B with a v/c ratio of 0.64 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at acceptable LOS C with a v/c ratio of 0.75 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative E Conditions, this study roadway segment would degrade to unacceptable LOS F with a v/c ratio of 1.30. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound during the weekday a.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.
- Route 3, from Finegayan Main Gate to Secondary Gate. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.09 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.24 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative E Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.41. The proposed action would increase traffic on this study roadway segment by approximately 128 vehicles during the weekday p.m. peak hour. This 12.3% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound direction during the weekday a.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.
- Route 3, from Secondary Gate to Route 28. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.23 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at LOS F with a v/c ratio of 1.36 in the southbound/westbound during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative E Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.52. The proposed action would increase the traffic on this study roadway segment by approximately 120 vehicles during the weekday a.m. peak hour. This 10.7% increase in traffic is greater than the 5.0% threshold of significance.

  During the weekday p.m. peak hour, this study roadway segment currently operates at acceptable LOS D with a v/c ratio 0.81 in the northbound/eastbound direction and acceptable LOS B with a v/c ratio of 0.67 and southbound/westbound directions hour under Existing conditions. This study roadway segment would continue to operate at acceptable LOS E with a v/c ratio of 0.91 and LOS C with a v/c ratio of 0.74 in the northbound/eastbound and southbound/westbound

directions, respectively, during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative E Conditions, this study roadway segment would degrade to unacceptable LOS F with a v/c ratio of 1.14 in the northbound/eastbound direction and 1.08 in the southbound/westbound direction during the weekday p.m. peak hour. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound directions during the weekday a.m. and p.m. peak hours, and in the northbound/eastbound direction during the weekday p.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.

- Route 3, from Route 28 to South Finegayan Main Gate. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.07 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would operate at unacceptable LOS F with a v/c ratio of 1.25 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative E Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.32. The proposed action would increase traffic on this study roadway segment by approximately 109 vehicles during the weekday p.m. peak hour. This 5.2% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the southbound/westbound direction on this study roadway segment during the weekday a.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.
- Route 3, from South Finegayan Main Gate to Route 1. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 2.11 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. Construction of roadway improvements (i.e., signalization of the intersections at Guam Regional Medical City and Okkodo High School and provision of an additional southbound through lane on Route 3) would increase the capacity of this roadway segment. However, despite the fact that these improvements would be constructed prior to Year 2030, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.35 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative E Conditions, this study roadway segment would continue to operate at unacceptable LOS F with a v/c ratio of 1.42. The proposed action would increase traffic on this study roadway segment by approximately 110 vehicles during the weekday a.m. peak hour. This 5.1% increase in traffic exceeds the 5.0% threshold of significance. Therefore, the proposed action would result in a significant impact in the southbound/westbound direction on this study roadway segment during the weekday a.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.
- Route 28, from Chalan Balako to Route 3. This study roadway segment currently operates at unacceptable LOS F with a v/c ratio of 1.08 in the southbound/westbound direction during the weekday a.m. peak hour under Existing Conditions. This study roadway segment would continue to operate at LOS F with a v/c ratio of 1.48 in the southbound/westbound direction during the weekday a.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative E Conditions, this study roadway segment would continue to operate at LOS F with a v/c ratio of 1.57 in the southbound/westbound direction during the weekday a.m. peak hour. The proposed action would increase the traffic on this study roadway segment by approximately 62 vehicles during the weekday a.m. peak hour. This 5.5% increase in traffic is greater than the 5.0% threshold of significance.

During the weekday p.m. peak hour, this study roadway segment currently operates at acceptable LOS B with a v/c ratio of 0.68 in the northbound/eastbound direction under Existing Conditions. This study roadway segment would operate at acceptable LOS E in the northbound/eastbound direction during the weekday p.m. peak hour under Year 2030 Baseline Conditions. Under Year 2030 Alternative E Conditions, this study roadway segment would degrade to operate at unacceptable LOS F with a v/c ratio of 1.05 in the northbound/eastbound direction during the weekday p.m. peak hour. Therefore, the proposed action would result in a significant impact on this study roadway segment in the southbound/westbound direction during the weekday a.m. peak hour and in the northbound/eastbound direction during the weekday p.m. peak hour. A similar impact was identified on this study roadway segment under Year 2030 Alternative A Conditions.

Significant impacts were identified for all impacted roadway segments. Potential mitigation measures for the impacted roadway segments would be similar in scope and scale to those identified in Section 6.1.2.1. Specifically, to reduce impacts to less than significant levels on these study roadway segments, the following potential mitigation measures may be implemented:

- Potential Mitigation Measure Fin-AAFB-Roads-1: Implement Potential Mitigation Measure Fin-Roads-1. With implementation of Potential Mitigation Measure Fin-Roads-1, traffic operations on Route 1, from Route 3 to Route 34 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Roads-2: Implement Potential Mitigation Measure Fin-Roads-2. With implementation of Potential Mitigation Measure Fin-Roads-2, traffic operations on Route 1, from Route 34 to Route 16 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Roads-3: Implement Potential Mitigation Measure Fin-Roads-3. With implementation of Potential Mitigation Measure Fin-Roads-3, traffic operations on Route 3, from Route 3A/9 to Finegayan Main Gate would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Roads-4: Implement Potential Mitigation Measure Fin-Roads-4. With implementation of Potential Mitigation Measure Fin-Roads-4, traffic operations on Route 3, from Finegayan Main Gate to Finegayan Residential Gate would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Roads-5: Implement Potential Mitigation Measure Fin-Roads-5. With implementation of Potential Mitigation Measure Fin-Roads-5, traffic operations on Route 3, from Finegayan Residential Gate to Route 28 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Roads-6: Implement Potential Mitigation Measure Fin-Roads-6. With implementation of Potential Mitigation Measure Fin-Roads-6, traffic operations on Route 3, from Route 28 to South Finegayan Main Gate would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)

- Potential Mitigation Measure Fin-AAFB-Roads-7: Implement Potential Mitigation Measure Fin-Roads-7. With implementation of Potential Mitigation Measure Fin-Roads-7, traffic operations on Route 3, from South Finegayan Main Gate to Route 1 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Roads-8: Implement Potential Mitigation Measure Fin-Roads-8. With implementation of Potential Mitigation Measure Fin-Roads-8, traffic operations on Route 28, from Chalan Balako to Route 3 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)

The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies, to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Intersection Operations

Intersection analysis was conducted to determine potential impacts to the off-base (external) intersections during weekday a.m. and p.m. peak hours. The LOS for each study intersection was compared to the baseline conditions to determine if any significant impacts would occur. An impact summary is provided in Table 6.1.2-40. The detailed results of the intersection analysis are provided in their entirety in Appendix F.

The addition of traffic generated by the proposed action would potentially result in a significant impact at ten study intersections during the weekday a.m. and/or weekday p.m. peak hours.

- Route 3 / Route 3A. This one-way stop-controlled study intersection currently operates at acceptable LOS B with 12.9 seconds of delay and would continue to operate at acceptable LOS C with 16.1 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative E Conditions, this study intersection would degrade to unacceptable LOS F with 56.4 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour. No impacts were identified at this study intersection under Year 2030 Alternative A Conditions.
- Route 3 / 9 / Chalan Santa Anita. This two-way stop-controlled study intersection currently operates at acceptable LOS C with 21.9 seconds of delay and would continue to operate at acceptable LOS E with 37.7 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative E Conditions, this study intersection would degrade to unacceptable LOS F with greater than 180.0 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour. A similar impact was identified at this study intersection under Year 2030 Alternative A Conditions.
- Route 3 / Royal Palm Drive. This two-way stop-controlled study intersection currently operates at acceptable LOS C with 16.3 seconds of delay and would operate at acceptable LOS E with 36.4 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative E Conditions, this study intersection would degrade to unacceptable LOS F with 54.1 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday

a.m. peak hour. A similar impact was identified at this study intersection under Year 2030 Alternative A Conditions.

- Route 1 / Route 3. This signalized study intersection currently operates at LOS F and would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. During the weekday p.m. peak hour this study intersection currently operates at LOS E with 70.8 seconds of delay and would continue to operate at LOS E with 63.4 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative E Conditions, this study intersection would continue to operate at LOS F with greater than 180.0 seconds of delay and the proposed action would add more than 50 vehicles to this poorly performing intersection during the weekday a.m. peak hour. During the weekday p.m. peak hour the intersection would degrade to operate at unacceptable LOS F with 83.0 seconds of delay. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours. A similar impact was identified at this study intersection under Year 2030 Alternative A Conditions.
- Route 1 / Route 27. This signalized study intersection currently operates at acceptable LOS E with 70.3 seconds of delay and would operate at unacceptable LOS F with 118.3 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative E Conditions, this study intersection would continue to operate at unacceptable LOS F with 121.6 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour. A similar impact was identified at this study intersection under Year 2030 Alternative A Conditions.
- Route 1 / Route 26. This signalized study intersection currently operates at acceptable LOS C with 27.9 seconds of delay and would operate at unacceptable LOS F with 87.6 seconds of delay during the weekday p.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative E Conditions, this study intersection would continue to operate at unacceptable LOS F with 91.9 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour. A similar impact was identified at this study intersection under Year 2030 Alternative A Conditions.
- Route 16 / Route 27. This signalized study intersection currently operates at acceptable LOS D with 50.1 seconds of delay and acceptable LOS E with 71.2 seconds of delay during the weekday a.m. and p.m. peak hours, respectively, under Existing Conditions. This signalized study intersection would operate at unacceptable LOS F with greater than 180.0 seconds of delay and 154.7 seconds of delay during the weekday a.m. and p.m. peak hours, respectively under Year 2030 Baseline Conditions. Under Year 2030 Alternative E Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay and 160.9 seconds of delay during the weekday a.m. and p.m. peak hours, respectively. The project would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. and p.m. peak hours. A similar impact was identified at this study intersection under Year 2030 Alternative A Conditions.

- Route 16 / Route 10A. This signalized study intersection currently operates at unacceptable LOS F and would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday a.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative E Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay. The project would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday a.m. peak hour. A similar impact was identified at this study intersection under Year 2030 Alternative A Conditions.
- Route 1 / Route 14A. This signalized study intersection currently operates at unacceptable LOS F with 156.1 seconds of delay during the weekday p.m. peak hour under Existing Conditions. This study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay during the weekday p.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative E Conditions, this study intersection would continue to operate at unacceptable LOS F with greater than 180.0 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour.
- Route 1 / Route 10A. This signalized study intersection currently operates at acceptable LOS E with 62.6 seconds of delay and would operate at unacceptable LOS F with 139.3 seconds of delay during the weekday p.m. peak hour under Existing Conditions and Year 2030 Baseline Conditions, respectively. Under Year 2030 Alternative E Conditions, this study intersection would continue to operate at unacceptable LOS F with 144.7 seconds of delay. The proposed action would add more than 50 vehicles to this poorly performing intersection. Therefore, the proposed action would result in a significant impact on this study intersection during the weekday p.m. peak hour. A similar impact was identified at this study intersection under Year 2030 Alternative A Conditions.

Significant impacts were identified for all impacted intersections. Potential mitigation measures for the impacted intersections would be similar in scope and scale to those identified in Section 6.1.2.1. Specifically, to reduce impacts to less than significant levels on these study intersections, the following potential mitigation measures may be implemented:

- Potential Mitigation Measure Fin-AAFB-Int-1: Implement Potential Mitigation Measure Fin-Int-1. With implementation of Potential Mitigation Measure Fin-Int-1, traffic operations at Route 3 / 9 / Chalan Santa Anita would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Int-2: Implement Potential Mitigation Measure Fin-Int-2. With implementation of Potential Mitigation Measure Fin-Int-2, traffic operations at Route 3 / Royal Palm Drive would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Int-3: Implement Potential Mitigation Measure Fin-Int-3. With implementation of Potential Mitigation Measure Fin-Int-3, traffic operations at Route 1 / Route 3 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)

- Potential Mitigation Measure Fin-AAFB-Int-4: Implement Potential Mitigation Measure Fin-Int-4. With implementation of Potential Mitigation Measure Fin-Int-4, traffic operations at Route 1 / Route 27 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Int-5: Implement Potential Mitigation Measure Fin-Int-5. With implementation of Potential Mitigation Measure Fin-Int-5, traffic operations at Route 1 / Route 26 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Int-6: Implement Potential Mitigation Measure Fin-Int-6. With implementation of Potential Mitigation Measure Fin-Int-6, traffic operations at Route 16 / Route 27 would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Int-7: Implement Potential Mitigation Measure Fin-Int-7. With implementation of Potential Mitigation Measure Fin-Int-7, traffic operations at Route 16 / Route 10A would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Int-8: Implement Potential Mitigation Measure Fin-Int-8. With implementation of Potential Mitigation Measure Fin-Int-8, traffic operations at Route 1 / Route 14A would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)
- Potential Mitigation Measure Fin-AAFB-Int-9: Implement Potential Mitigation Measure Fin-Int-9. With implementation of Potential Mitigation Measure Fin-Int-9, traffic operations at Route 1 / Route 10A would improve and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)

A significant impact would also occur at Route 3 / Route 3A. Implementation of Potential Mitigation Measure Fin-AAFB-Int-1 would improve conditions at this intersection and the significant adverse impact would be mitigated to less than significant levels. Therefore, this impact is considered to be significant but mitigable. (SI-M)

The final list of implementable mitigation measures will be dependent on the selected alternative or combination of alternatives and based on project-level technical studies, to be conducted after the alternative or combination of alternatives is selected. FHWA will conduct all NEPA documentation efforts and any associated resource consultations as specific mitigation measures are proposed.

Transit Conditions

Transit conditions under Alternative E with Alternative 1 would be similar to those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Pedestrian and Bicycle Conditions

Pedestrian and bicycle conditions under Alternative E with Alternative 1 would be similar to those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Public Health and Safety

Impacts to public health and safety from the combination of alternatives are related to the travel between the cantonment and the LFTRC. Therefore, impacts to public health and safety associated with the

combination of Alternative E and Alternative 1 would be the same as discussed for Alternative A and B with Alternative 1 in Section 6.1.2.1.

6.1.2.11 Finegayan Cantonment/AAFB Family Housing (Alternative E) with any NAVMAG LFTRC Alternative (alternatives 2, 3, or 4)

Air Quality

The combined air quality impacts would be the same as those described in Section 6.1.2.1. The combined construction island-wide emissions impacts, summarized in Table 6.1.2-1, would be less than significant as a result of this combined alternative.

Terrestrial Biological Resources

Finegayan Cantonment/AAFB Family Housing (Alternative E) with NAVMAG (East/West) LFTRC (Alternative 2)

The additive impacts of implementing cantonment/family housing Alternative E with LFTRC Alternative 2 and the IT/COMM infrastructure are provided in Table 6.1.2-41. Overall, approximately 827 acres (335 ha) of limestone forest, or 4% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,148 acres (465 ha) of Overlay Refuge lands, or 5% of the total Overlay Refuge currently present on Guam, would be disturbed. The majority (94%) of the impacts to terrestrial biological resources would occur under Alternative E, with 780 acres (316 ha) of limestone forest disturbed. The proposed IT/COMM alignment contributes very little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-41. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan Cantonment/AAFB Family Housing (Alternative E) with NAVMAG (East/West) LFTRC (Alternative 2) and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative E	2 (0.8)	778 (315)	1,065 (431)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 719 (291) MC: 719 (291) GR: 507 (205) GMK: 719 (291) Ser: 648 (262)
Alternative 2	0	19 (8)	0	-	-	MFB: 43 (17) MC: 43 (17) GR: 49 (20) GMK: 43 (17) Ser: 18 (7)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**6 (2)**	**821 (332)**	**1,148 (465)**	-	-	**MFB: 798 (323)** **MC: 799 (323)** **GR: 693 (280)** **GMK: 798 (323)** **Ser: 696 (282)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.
Notes: (1) Direct impact - conversion to developed areas.
(2) Only species for which there would be a significant impact.

Finegayan Cantonment/AAFB Family Housing (Alternative E) with NAVMAG (North/South) LFTRC (Alternative 3)

The additive impacts of implementing cantonment/family housing Alternative E with LFTRC Alternative 3 and the IT/COMM infrastructure are provided in Table 6.1.2-42. Overall, approximately 977 acres (395 ha) of limestone forest, or 5% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,423 acres (576 ha) of Overlay Refuge lands, or 7% of the total Overlay Refuge currently present on Guam, would be disturbed. The majority (79%) of the impacts to terrestrial biological resources would occur under Alternative E, with 780 acres (316 ha) of limestone forest disturbed. The proposed IT/COMM alignment contributes very little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-42. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan Cantonment/AAFB Family Housing (Alternative E) with NAVMAG (North/South) LFTRC (Alternative 3) and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative E	2 (0.8)	778 (315)	1,065 (431)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 719 (291) MC: 719 (291) GR: 507 (205) GMK: 719 (291) Ser: 648 (262)
Alternative 3	105 (42)	64 (26)	275 (111)	MFB, MC, GR, GMK, Ser	PSTG	MFB: 223 (90) MC: 230 (93) GR: 24 (10) GMK: 223 (90) Ser: 40 (16)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**111 (45)**	**866 (350)**	**1,423 (576)**	-	-	**MFB: 978 (396)** **MC: 986 (399)** **GR: 668 (270)** **GMK: 978 (396)** **Ser: 718 (291)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Finegayan Cantonment/AAFB Family Housing (Alternative E) with NAVMAG (L-shaped) LFTRC (Alternative 4)

The additive impacts of implementing cantonment/family housing Alternative E with LFTRC Alternative 4 and the IT/COMM infrastructure are provided in Table 6.1.2-43. Overall, approximately 938 acres (380 ha) of limestone forest, or 5% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,367 acres (553 ha) of Overlay Refuge lands, or 6% of the total Overlay Refuge currently present on Guam, would be disturbed. The majority (83%) of the impacts to terrestrial biological resources would occur under Alternative E, with 780 acres (316 ha) of limestone forest

disturbed. The proposed IT/COMM alignment contributes very little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-43. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan Cantonment/AAFB Family Housing (Alternative E) with NAVMAG (L-shaped) LFTRC (Alternative 4) and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*
Alternative E	2 (0.8)	778 (315)	1,065 (431)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 719 (291) MC: 719 (291) GR: 507 (205) GMK: 719 (291) Ser: 648 (262)
Alternative 4	67 (27)	63 (26)	219 (88)	MFB, MC, GMK	PSTG	MFB: 161 (65) MC: 166 (67) GR: 50 (20) GMK: 161 (65) Ser: 19 (8)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)
Total	**73 (30)**	**865 (350)**	**1,367 (553)**	-	-	**MFB: 916 (371)** **MC: 922 (373)** **GR: 694 (281)** **GMK: 916 (371)** **Ser: 697 (282)**

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MFB = Mariana fruit bat, MS = moth skink, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.
Notes: [(1)] Direct impact - conversion to developed areas.
[(2)] Only species for which there would be a significant impact.

Cultural Resources

Adverse effects to historic properties and impacts to other cultural resources of cultural importance resulting from the implementation of Alternatives E and 2, 3, or 4 would be similar to the combined effects and impacts of Finegayan Cantonment/Family Housing Alternative A with any NAVMAG LFTRC Alternative (Alternatives 2, 3, or 4) as discussed in Section 6.1.2.2. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives.

Table 6.1.2-44 lists 12 known archaeological sites within the IT/COMM lines PDIA for Alternative E and LFTRC Alternatives 2, 3, or 4. One site, a portion of NWF, is eligible for inclusion on the NRHP. Eleven archaeological sites are not eligible for listing in the NRHP. The literature review indicated that there are also areas that were not previously surveyed that have a potential for buried cultural resources along Routes 1, 5, 15, and 17.

Table 6.1.2-44. Archaeological Sites within the IT/COMM Lines Potential Impacted Area for Finegayan Cantonment/AAFB Family Housing (Alternative E) and LFTRC Alternatives 2, 3, or 4

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-07-2119	1001*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle dump	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-08-0213	T-16	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
66-08-1065***		Airfield	Post-WWII/Second American Territorial	Aaron *et al.* 2007	Yes	A
	36*	Flagpole	Post-WWII/Second American Territorial	Lauter-Reinman 1997	No	NA
	377*	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
	1066*	Concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA
	T-A4S-5	Concrete pads	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
	T-H-1	Artifact scatter and concrete foundations	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
66-08-2714	T-WAW-016	Bottle scatter	Pre-Contact/Latte; WWII Japanese Military Occupation, Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA

Legend: GHPI = Guam Historic Properties Inventory; NRHP = National Register of Historic Places; NA=not applicable; NRHP criterion A = eligible because they are associated with events that have made a significant contribution to the broad pattern of history, criterion D = eligible for potential to yield information important in prehistory or history.

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.

*Map Numbers from Welch (2009) (Map no. 36, 377,) or Welch (2010) (Map no. 1066).

**Revised to match Guam GHPI forms dated May 28, 2014.

***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

The installation of IT/COMM links between the Alternative E and the LFTRC Alternatives 2, 3, or 4 has the potential to result in adverse effects from excavation and soil removal to two historic properties, including one NRHP-eligible archaeological sites (see Table 6.1.2-44) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining area. No TCPs have been identified in the potential impacted areas for the IT/COMM lines.

No direct or indirect adverse effects due to operation of the IT/COMM utilities would occur as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

Alternative E was modeled with Alternative 5 (Section 3.12.1). Pairing Alternative E with Alternative 2, 3, or 4 may result in a slight increase in vehicles (less than 5%) on roadway segments and at intersections that comprise the most direct route between the Alternative E Main Gate and the Alternative 2, 3, or 4 gates, as well as a slight decrease in vehicles on roadway segments and at intersections that comprise the most direct route between the modeled combination Alternative E Main Gate and the Alternative 5 gate (see Figure 6.1.2-6). This minimal incremental increase or decrease in traffic volumes would not adversely affect LOS on roadways or at intersections along the route.

Roadway Segment Operations

Impacts and potential mitigation measures for all off-base (external) roadway segments would be the same as those identified in Section 6.1.2.10 (see Table 6.1.2-40). Significant impacts were identified on eight roadway segments. Potential mitigation measures would be feasible at all locations and could reduce the identified significant impacts to less than significant levels. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

Intersection Operations

Impacts and potential mitigation measures for all intersections would be the same as those identified in Section 6.1.2.10 (see Table 6.1.2-40). Significant impacts were identified at ten intersections. Potential mitigation measures would be feasible at all locations and could reduce the identified significant impacts to less than significant levels. The detailed results of the intersection analysis are provided in its entirety in Appendix F.

Transit Conditions

Transit conditions under Alternative E with Alternative 2, 3, or 4 would be similar to those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Pedestrian and Bicycle Conditions

Pedestrian and bicycle conditions under Alternative E with Alternative 2, 3, or 4 would be similar to those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Public Health and Safety

Impacts to public health and safety from the combination of alternatives are related to the travel between the cantonment and the LFTRC. Therefore, impacts to public health and safety associated with the combination of Alternative E and Alternatives 2, 3, or 4 would be the same as discussed for Alternative A and B with Alternatives 2, 3, or 4 in Section 6.1.2.1.

6.1.2.12 Finegayan Cantonment/AAFB Family Housing (Alternative E) with NWF LFTRC (Alternative 5)

Air Quality

The combined air quality impacts would be the same as those described in Section 6.1.2.1. The combined construction island-wide emissions impacts, summarized in Table 6.1.2-1, would be less than significant as a result of this combined alternative.

Terrestrial Biological Resources

The additive impacts of implementing cantonment/family housing Alternative E with LFTRC Alternative 5 and the IT/COMM infrastructure are provided in Table 6.1.2-45. Overall, approximately 1,027 acres (416 ha) of limestone forest, or 5% of the total limestone forest currently present on Guam, would be disturbed. In addition, approximately 1,446 acres (585 ha) of Overlay Refuge lands, or 7% of the total Overlay Refuge currently present on Guam, would be disturbed. The majority (76%) of the impacts to terrestrial biological resources would occur under Alternative E, with over 780 acres (316 ha) of limestone forest disturbed. The proposed IT/COMM alignment contributes very little to the overall potential impact to terrestrial biological resources. Additive impacts to terrestrial biological resources would be less than significant.

Table 6.1.2-45. Summary of Impacts to Terrestrial Biological Resources with Implementation of Finegayan Cantonment/AAFB Family Housing (Alternative E) with NWF LFTRC (Alternative 5), and IT/COMM Infrastructure

Component	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Special-Status Species[(2)]*	*Guam-Listed Special-Status Species[(2)]*	*Recovery Habitat (acres [ha])*	*Critical Habitat (acres [ha])*
Alternative E	2 (0.8)	778 (315)	1,065 (431)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 719 (291) MC: 719 (291) GR: 507 (205) GMK: 719 (291) Ser: 648 (262)	NA
Alternative 5	89 (36)	130 (53)	298 (121)	MFB, MC, GMK, Ser	-	MFB: 215 (87) MC: 215 (87) GR: 82 (33) GMK: 215 (87) Ser: 177 (71)	MFB, MC, GMK: 11 (5)
IT/COMM	4 (2)	24 (10)	83 (34)	-	-	MFB: 36 (15) MC: 37 (15) GR: 137 (55) GMK: 36 (15) Ser: 30 (12)	NA
Total	**95 (39)**	**932 (377)**	**1,446 (585)**	-	-	**MFB: 970 (392)** **MC: 971 (393)** **GR: 726 (294)** **GMK: 970 (392)** **Ser: 855 (346)**	

Cultural Resources

Adverse effects to historic properties and impacts to natural resources of cultural importance resulting from the implementation of Alternatives E and 5 would be similar to the combined effects and impacts of Finegayan Cantonment/Family Housing Alternative A with NWF LFTRC Alternative 5 discussed in

Section 6.1.2.3. Additional effects and impacts could also result from the construction of the IT/COMM links for these alternatives.

Table 6.1.2-46 lists 17 known archaeological sites within the IT/COMM lines PDIA. Five of the sites, two artifact scatters, a Japanese defensive complex, a historic encampment, and portions of NWF, are eligible for inclusion on the NRHP. Twelve archaeological sites are not eligible for listing in the NRHP. One structure eligible for listing in the NRHP, North Field, is located within the potential impacted area. No TCPs have been identified in the potential impacted areas for the IT/COMM lines. The literature review indicated that there are also areas that were not previously surveyed that have a potential for buried cultural resources along Routes 1, 5, 15, and 17.

Table 6.1.2-46. Archaeological Sites within the IT/COMM Utilities Potential Impacted Area for Finegayan Cantonment/AAFB Family Housing (Alternative E) and Alternative 5

GHPI Number†	*Temporary Site Number/ Map Number**	*Site Type*	*Period***	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-02-1657	493*	Japanese defensive complex	WWII Japanese Military Occupation	Allen *et al.* 2002	Yes	D
66-02-2644	T-AP-002	Concrete pads (remains of medical supply storehouse no. 13)	Post-WWII/Second American Territorial	Dixon *et al.* 2014	No	NA
66-07-2119	1001*	Artifact scatter	Pre-Contact/Latte	Welch 2010	No	NA
66-07-2124	1006*	Bottle dump	Post-WWII/Second American Territorial	Welch 2010	No	NA
66-07-2127	1009*	Artifact scatter	Pre-Contact/Latte	Grant *et al.* 2007	No	NA
66-07-2128	1010*	Concrete pad	Post-WWII? Second American Territorial	Grant *et al.* 2007	No	NA
66-07-2321	T-11/1046*	Ceramic/ artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-1065***		Airfield	Post-WWII/Second American Territorial	Aaron *et al.* 2007	Yes	A
66-08-2305	ANT-6/1028	Encampment	Post-WWII/Second American Territorial	Welch 2010	Yes	D
66-08-2308***	ANT-10/1034	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-08-2714	T-WAW-016	Bottle Scatter	Pre-Contact/Latte, WWII Japanese Military Occupation, Post-WWII/ Second American Territorial	Dixon *et al.* 2014	No	NA
	36*	Flagpole	Post-WWII/Second American Territorial	Lauter-Reinman 1997	No	NA
	377*	Ceramic scatter	Pre-Contact/Latte	Kurashina *et al.* 1987	No	NA
	1066*	Concrete pads, roads, other remains	Post-WWII/Second American Territorial	Welch 2010	No	NA
	T-A4S-5	Concrete pads	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
	T-H-1	Artifact scatter and concrete foundations	Post-WWII/Second American Territorial	Dixon and Walker 2011	No	NA
	T-MSAU-1	Japanese dump and groundstone tool	Pre-Contact/Latte; WWII Japanese Military Occupation	Church *et al.* 2009	No	NA

Notes: *Map Numbers from Welch (2009) (Map no. 36, 377) or Welch (2010) (Map no. 1046, 1066).
**Revised to match Guam GHPI forms dated May 28, 2014.
***The Guam SHPO concurs with this recommendation (Guam SHPO correspondence dated July 2 and September 17, 2014 [RC2013-0853]).

The installation of IT/COMM links between Alternative E and the LFTRC Alternative 5 has the potential to result in adverse effects from excavation and soil removal to six historic properties, including five NRHP-eligible archaeological sites (see Table 6.1.2-46) and one NRHP-eligible structure (North Field). Based on an examination of previous investigations and predictive modeling, there is a low potential for NRHP-eligible sites in the remaining areas. No TCPs would be affected by the construction of the IT/COMM links.

No direct or indirect adverse effects due to operation of the IT/COMM utilities would occur as these lines would be buried and there would be no change in use, and no effects to the setting.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. To the degree possible, impacts to historic properties and other resources of cultural importance would be avoided during the planning process. Consultation under the 2011 PA will address potential adverse effects and alternatives to avoid adverse effects. If avoidance is not possible, potential minimization and mitigation measures may include data recovery and monitoring during construction. However, final mitigation will be determined after completion of the consultation process outlined in the PA. With the implementation of these measures and processes as outlined in the 2011 PA, additive impacts associated with IT/COMM would be reduced to a level below significance.

Ground Transportation

Alternative A was modeled with Alternative 5 (Section 3.12.1).

Roadway Segment Operations

Impacts and potential mitigation measures for all off-base (external) roadway segments under Alternative E with Alternative 5 would be the same as those identified in Section 6.1.2.10 (see Table 6.1.2-40). Significant impacts were identified on eight roadway segments. Potential mitigation measures would be feasible at all locations and could reduce the identified significant impacts to less than significant levels. The detailed results of the roadway segment analysis are provided in their entirety in Appendix F.

Intersection Operations

Impacts and potential mitigation measures for all intersections under Alternative A with Alternative 5 would be the same as those identified in Section 6.1.2.10 (see Table 6.1.2-40) for Alternative E with Alternative 1. Potential mitigation measures were identified for all impacted intersections, and if implemented, could reduce the impacts to less than significant levels. Significant impacts were identified at ten intersections. The detailed results of the intersection analysis are provided in its entirety in Appendix F.

Transit Conditions

Transit conditions under Alternative E with Alternative 5 would be similar to those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Pedestrian and Bicycle Conditions

Pedestrian and bicycle conditions under Alternative E with Alternative 5 would be similar to those described in Section 6.1.2.1 for Alternative A with Alternative 1.

Public Health and Safety

Impacts to public health and safety from the combination of alternatives are related to the travel between the cantonment and the LFTRC. Therefore, impacts to public health and safety associated with the combination of Alternative E and Alternative 5 would be the same as discussed for Alternative A and B with Alternative 5 in Section 6.1.2.1.

6.1.3 Summary of Additive Impacts

Table 6.1.3-1 summarizes the additive impacts to the resources that would be impacted by unique site combinations, as discussed in Section 6.1.2.

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Table 6.1.3-1. Summary of Additive Impacts and Potential Mitigation Measures

Cantonment/Housing Alternative A or B with LFTRC Alternative 1	***Cantonment/Housing Alternative A or B with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative A or B with LFTRC Alternative 5***	***Cantonment/Housing Alternative C with LFTRC Alternative 1***	***Cantonment/Housing Alternative C with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative C with LFTRC Alternative 5***	***Cantonment/Housing Alternative D with LFTRC Alternative 1***	***Cantonment/Housing Alternative D with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative D with LFTRC Alternative 5***	***Cantonment/Housing Alternative E with LFTRC Alternative 1***	***Cantonment/Housing Alternative E with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative E with LFTRC Alternative 5***
GEOLOGICAL AND SOIL RESOURCES											
LSI Direct, short-term construction impacts along any of the IT/COMM routes. Earthmoving activities would occur mostly in roadways or other previously disturbed areas. BMPs would be utilized to minimize erosion within the project construction footprint.											
WATER RESOURCES											
LSI IT/COMM construction would increase potential for short-term increases in stormwater runoff and erosion. The size and nature of the potentially disturbed area would vary marginally depending on the IT/COMM route, and some routes are closer to surface waters and wetlands than others. However, through compliance with the Construction General Permit and Program SWPPP and implementation of a site-specific SWPPPs, and associated erosion control, runoff reduction, and sediment removal BMPs, impacts to surface water resources would be minimized and off-site transport of stormwater runoff would be unlikely except during extreme weather events (i.e., typhoons). These stormwater runoff protection measures would also serve to protect surface water, groundwater, and wetlands from indirect impacts and prevent impacts to nearshore waters. Because the IT/COMM lines would primarily be located in existing roadways, no direct impacts to wetlands or other waters of the U.S. are anticipated. The potential exposure to direct or indirect impacts at any one location or resource would be short-term, given that construction would not occur simultaneously along the entire IT/COMM route at any one time and construction at any one location would be of relatively short duration. Based on these considerations, the additive impacts of IT/COMM construction activities would be less than significant.											
AIR QUALITY											
LSI Hot-spot concentrations for mobile source CO, PM, and MSATs would be below standards. Construction emissions would be below the significance criterion for all combinations. Alternative A combination would be outside SO_2 nonattainment areas, so no additive impacts with respect to the CAA general conformity requirement. Portions of the Alternative B combination would occur in Tanguisson SO_2 area but emissions would be below *de minimis*, so formal CAA conformity determination not required.	***LSI*** Impacts would be the same as described for Alternatives A or B with Alternative 1.	***LSI*** Impacts would be the same as described for Alternatives A or B with Alternative 1.	***LSI*** Hot-spot concentration results would be the same as described for Alternatives A or B with Alternative 1. Construction emissions would be marginally different than for Alternative A or B combinations with Alternative 1 but would also be below pollutant thresholds. This combination would be outside SO_2 nonattainment areas, so no additive impacts with respect to the CAA general conformity requirement.	***LSI*** Impacts would be the same as described for Alternative C with Alternative 1.	***LSI*** Impacts would be the same as described for Alternative C with Alternative 1.	***LSI*** Hot-spot concentration results would be the same as described for Alternatives A or B with Alternative 1. Construction emissions would be marginally different than for Alternative A, B, or C combinations with Alternative 1 but would also be below pollutant thresholds. This combination would be outside SO_2 nonattainment areas, so no additive impacts with respect to the CAA general conformity requirement.	***LSI*** Impacts would be the same as described for Alternative D with Alternative 1.	***LSI*** Impacts would be the same as described for Alternative D with Alternative 1.	***LSI*** Impacts would be the same as described for Alternative A or B with Alternative 1.	***LSI*** Impacts would be the same as described for Alternative A or B with Alternative 1.	***LSI*** Impacts would be the same as described for Alternative A or B with Alternative 1.
NOISE											
LSI Additive noise impacts from IT/COMM construction would only occur in close proximity to the construction activities and would primarily occur along existing roadways that have higher levels of ambient noise from road traffic and other sources. Installation of the IT/COMM lines would be very short-term, lasting only a few days near any given noise receptor before moving along the road easement. Accordingly, the impacts would be less than significant.											
AIRSPACE											
No additive airspace impacts under any combination of alternatives.											
LAND AND SUBMERGED LAND USE											
No additive land and submerged land use impacts under any combination of alternatives.											
RECREATIONAL RESOURCES											
No additive recreational resources impacts under any combination of alternatives.											

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 6.1.3-1. Summary of Additive Impacts and Potential Mitigation Measures

Cantonment/Housing Alternative A or B with LFTRC Alternative 1	***Cantonment/Housing Alternative A or B with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative A or B with LFTRC Alternative 5***	***Cantonment/Housing Alternative C with LFTRC Alternative 1***	***Cantonment/Housing Alternative C with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative C with LFTRC Alternative 5***	***Cantonment/Housing Alternative D with LFTRC Alternative 1***	***Cantonment/Housing Alternative D with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative D with LFTRC Alternative 5***	***Cantonment/Housing Alternative E with LFTRC Alternative 1***	***Cantonment/Housing Alternative E with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative E with LFTRC Alternative 5***
Terrestrial Biological Resources (acres [ha])												
LSI Both Combinations Disturbance to: LF - 28 (11) OR - 83 (34) Recovery Habitat MFB-36 (15) MC-37 (15) GR-137 (55) GMK-36 (15) Ser-30 (12)	***LSI*** All Combinations Disturbance to: LF - 28 (11) OR - 83 (34) Recovery Habitat MFB-36 (15) MC-37 (15) GR-137 (55) GMK-36 (15) Ser-30 (12)	***LSI*** Both Combinations Disturbance to: LF - 28 (11) OR - 83 (34) Recovery Habitat MFB-36 (15) MC-37 (15) GR-137 (55) GMK-36 (15) Ser-30 (12)	***LSI*** Disturbance to: LF - 26 (10) OR - 78 (32) Recovery Habitat MFB-30 (12) MC-29 (12) GR-140 (57) GMK-30 (12) Ser-22 (9)	***LSI*** All Combinations Disturbance to: LF - 26 (10) OR - 78 (32) Recovery Habitat MFB-30 (12) MC-29 (12) GR-140 (57) GMK-30 (12) Ser-22 (9)	***LSI*** Disturbance to: LF - 26 (10) OR - 78 (32) Recovery Habitat MFB-30 (12) MC-29 (12) GR-140 (57) GMK-30 (12) Ser-22 (9) Critical Habitat MFB, MC, GMK - 12 (5)	***LSI*** Disturbance to: LF - 31 (13) OR - 78 (32) Recovery Habitat MFB-50 (20) MC-50 (20) GR-144 (58) GMK-50 (20) Ser-42 (17)	***LSI*** All Combinations Disturbance to: LF - 31 (13) OR - 78 (32) Recovery Habitat MFB-50 (20) MC-50 (20) GR-144 (58) GMK-50 (20) Ser-42 (17)	***LSI*** Disturbance to: LF - 31 (13) OR - 78 (32) Recovery Habitat MFB-50 (20) MC-50 (20) GR-144 (58) GMK-50 (20) Ser-42 (17) Critical Habitat MFB, MC, GMK - 12 (5)	***LSI*** Disturbance to: LF - 28 (11) OR - 83 (34) Recovery Habitat MFB-36 (15) MC-37 (15) GR-137 (55) GMK-36 (15) Ser-30 (12)	***LSI*** Disturbance to: LF - 28 (11) OR - 83 (34) Recovery Habitat MFB-36 (15) MC-37 (15) GR-137 (55) GMK-36 (15) Ser-30 (12)	***LSI*** Disturbance to: LF - 28 (11) OR - 83 (34) Recovery Habitat MFB-36 (15) MC-37 (15) GR-137 (55) GMK-36 (15) Ser-30 (12)
Legend: GR = Guam rail, KF = Guam Micronesian kingfisher, LF = limestone forest, MC = Mariana crow, MFB = Mariana fruit bat, OR = Overlay Refuge, Ser = *Serianthes.*												
Marine Biological Resources												
No additive marine biological impacts under any combination of alternatives.												
Cultural Resources												
SI-M Potential adverse effects to 2 historic properties. No adverse effects from operation of IT/COMM. Measures outlined in the 2011 PA would reduce impacts to a level below significance.	***SI-M*** Potential adverse effects to 2 historic properties. No adverse effects from operation of IT/COMM. Measures outlined in the 2011 PA would reduce impacts to a level below significance.	***SI-M*** Potential adverse effects to 6 historic properties. No adverse effects from operation of IT/COMM. Measures outlined in the 2011 PA would reduce impacts to a level below significance.	***SI-M*** Potential adverse effects to 4 historic properties. No adverse effects from operation of IT/COMM. Measures outlined in the 2011 PA would reduce impacts to a level below significance.	***SI-M*** Potential adverse effects to 4 historic properties. No adverse effects from operation of IT/COMM. Measures outlined in the 2011 PA would reduce impacts to a level below significance.	***SI-M*** Potential adverse effects to 4 historic properties. No adverse effects from operations. Measures outlined in the 2011 PA would reduce impacts to a level below significance.	***SI-M*** Potential adverse effects to 5 historic properties. No adverse effects from operation of IT/COMM. Measures outlined in the 2011 PA would reduce impacts to a level below significance.	***SI-M*** Potential adverse effects to 5 historic properties. No adverse effects due to operation of IT/COMM. Measures outlined in the 2011 PA would reduce impacts to a level below significance.	***SI-M*** Potential adverse effects to 5 historic properties. No adverse effects from operations. Measures outlined in the 2011 PA would reduce impacts to a level below significance.	***SI-M*** Potential adverse effects to 2 historic properties. No adverse effects from operation of IT/COMM. Measures outlined in the 2011 PA would reduce impacts to a level below significance.	***SI-M*** Potential adverse effects to 2 historic properties. No adverse effects from operation of IT/COMM. Measures outlined in the 2011 PA would reduce impacts to a level below significance.	***SI-M*** Potential adverse effects to 6 historic properties. No adverse effects from operation of IT/COMM. Measures outlined in the 2011 PA would reduce impacts to a level below significance.
Visual Resources												
No additive visual resources impacts under any combination of alternatives.												
Ground Transportation												
SI-M Alternative A/ Alternative 1 Slight increase in traffic on segments and intersections between cantonment/ family housing and LFTRC. Significant impacts on 8 segments in at least 1 direction and 9 intersections for weekday a.m. and/or p.m. peak hours. Implementation of potential mitigation measures listed in Section 6.1.2.1 would reduce impacts to less than significant at all locations. ***SI/SI-M*** Alternative B/	***SI-M*** Alternative A/ Alternatives 2, 3, or 4 Same as Alternative A/ Alternative 1. Alternative B/ Alternatives 2, 3, or 4 Same as Alternative B/ Alternative 1.	***SI-M*** Alternative A/ Alternative 5 Same as Alternative A/ Alternative 1. Alternative B/ Alternative 5 Same as Alternative B/ Alternative 1.	***SI*** Slight increase in traffic on segments and intersections between cantonment/ family housing and LFTRC. Potentially significant impact on 6 segments in at least one direction and at 11 intersections during weekday a.m. and/or weekday p.m. peak hours. Potential mitigation measures have not been identified at these locations.	***SI*** Same as Alternative C/ Alternative 1.	***SI*** Same as Alternative C/ Alternative 1.	***SI*** Slight increase in traffic on segments and intersections between cantonment/ family housing and LFTRC. Potentially significant impact on 12 segments in at least one direction and at 8 study intersections during the weekday a.m. and/or weekday p.m. peak hours. Potential mitigation measures have not been identified at these locations.	***SI*** Same as Alternative D/ Alternative 1.	***SI*** Same as Alternative D/ Alternative 1.	***SI-M*** Slight increase in traffic on segments and intersections between the cantonment, family housing, and LFTRC. Significant impacts on 8 segments in at least 1 direction and 10 intersections for weekday a.m. and/or p.m. peak hours. Implementation of potential mitigation measures listed in Section 6.1.2.1 would reduce impacts to less than significant at all locations. ***SI/SI-M***	***SI-M*** Same as Alternative E/ Alternative 1.	***SI-M*** Same as Alternative E/ Alternative 1.

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 6.1.3-1. Summary of Additive Impacts and Potential Mitigation Measures

Cantonment/Housing Alternative A or B with LFTRC Alternative 1	***Cantonment/Housing Alternative A or B with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative A or B with LFTRC Alternative 5***	***Cantonment/Housing Alternative C with LFTRC Alternative 1***	***Cantonment/Housing Alternative C with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative C with LFTRC Alternative 5***	***Cantonment/Housing Alternative D with LFTRC Alternative 1***	***Cantonment/Housing Alternative D with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative D with LFTRC Alternative 5***	***Cantonment/Housing Alternative E with LFTRC Alternative 1***	***Cantonment/Housing Alternative E with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative E with LFTRC Alternative 5***
Alternative 1 Slight increase in traffic on segments and intersections between cantonment/ family housing and LFTRC. Significant impact on 10 segments in at least one direction and 11 intersections for weekday a.m. and/or p.m. peak hours. Potential mitigation measures have been identified for 8 segments and 10 intersections. Implementation of potential mitigation measures listed in Section 6.1.2.1 would reduce impacts to less than significant at these locations. Impacts would be considered significant at 2 segments and 1 intersection. Potential mitigation measures have not been identified for these locations.											
Both Combinations ***LSI*** Transit conditions and increased potential for collisions with bicyclists and pedestrians.	***LSI*** Same as Alternative A/ Alternative 1.	***LSI*** Same as Alternative A/ Alternative 1.	***LSI*** Same as Alternative A/ Alternative 1.	***LSI*** Same as Alternative A/ Alternative 1.	***LSI*** Same as Alternative A/ Alternative 1.	***NI*** Transit conditions and potential for collisions with bicyclists and pedestrians.	***NI*** Transit conditions and potential for collisions with bicyclists and pedestrians.	***LSI*** Same as Alternative D/ Alternative 1.	***LSI*** Same as Alternative A/ Alternative 1.	***LSI*** Same as Alternative A/ Alternative 2, 3, or 4.	***LSI*** Same as Alternative A/ Alternative 1.
MARINE TRANSPORTATION											
No additive marine transportation impacts under any combination of alternatives.											
UTILITIES											
No additive utilities impacts under any combination of alternatives.											
SOCIOECONOMICS AND GENERAL SERVICES											
	LSI IT/COMM utility easement would be required for Alternatives 2 and 4.			***LSI*** IT/COMM utility easement would be required for Alternatives 2 and 4.			***LSI*** IT/COMM utility easement would be required for Alternatives 2 and 4.			***LSI*** IT/COMM utility easement would be required for Alternatives 2 and 4.	

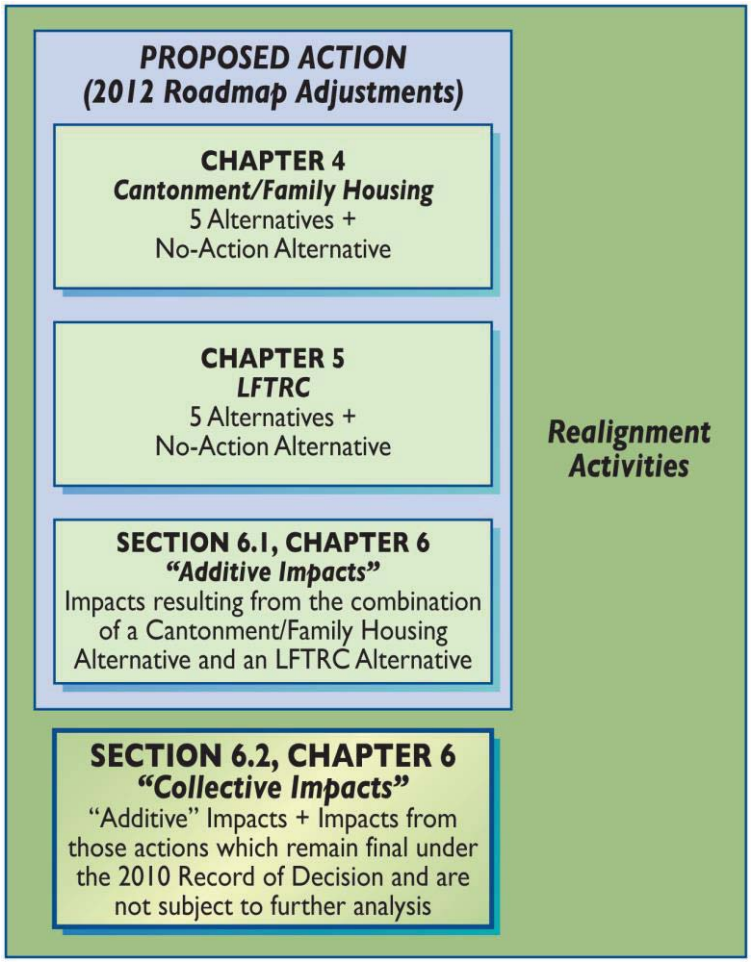
Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant; ***NI*** = no impact; ***BI*** = beneficial impact.

Table 6.1.3-1. Summary of Additive Impacts and Potential Mitigation Measures

Cantonment/Housing Alternative A or B with LFTRC Alternative 1	***Cantonment/Housing Alternative A or B with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative A or B with LFTRC Alternative 5***	***Cantonment/Housing Alternative C with LFTRC Alternative 1***	***Cantonment/Housing Alternative C with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative C with LFTRC Alternative 5***	***Cantonment/Housing Alternative D with LFTRC Alternative 1***	***Cantonment/Housing Alternative D with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative D with LFTRC Alternative 5***	***Cantonment/Housing Alternative E with LFTRC Alternative 1***	***Cantonment/Housing Alternative E with LFTRC Alternatives 2, 3, or 4***	***Cantonment/Housing Alternative E with LFTRC Alternative 5***
Hazardous Materials and Waste											
LSI Hazardous substances are not anticipated to be widely used or generated for the installation of IT/COMM lines at or between the main cantonment, housing, or LFTRC site; any use would be managed according to best management practices. Contaminated sites would be avoided when possible, and a site-specific health and safety plan would be used to ensure that the risk of human exposure to contaminated media is minimized. There would be no additive impacts uniquely associated with the site combinations or operation of the proposed action.											
Public Health and Safety											
LSI Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***NI*** Travel distance between sites is short. There are no high-frequency crash intersections along the route.	***LSI*** Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***LSI*** Travel distance between sites is relatively long. 5 high-crash frequency intersections between the Alternative A and B area and Alternative 2. 2 high-crash frequency intersections between the Alternative A and B area and Alternatives 3 and 4. Traffic improvements completed in 2012. Added vehicles would be minimal portion of total vehicles on roadways.	***LSI*** Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***NI*** Travel distance between sites is short. There are no high-frequency crash intersections along the route.	***LSI*** Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***NI*** Travel distance between sites is short. There are no high-frequency crash intersections along the route.	***LSI*** Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***LSI*** Travel distance between sites is relatively long. 5 high-crash frequency intersections between Alternative C area and Alternative 2 and 2 between Alternative C area and Alternatives 3 and 4. The added vehicles traveling between the main cantonment and LFTRC would be a minimal portion of total vehicles on these roadways.	***LSI*** Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***NI*** Travel distance between sites is short. There are no high-frequency crash intersections along the route.	***LSI*** Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***LSI*** Travel distance between sites is relatively short. 1 high-crash frequency intersections between Alternative D area and Alternative 1.	***LSI*** Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***LSI*** Travel distance between sites is relatively long. 1 high-crash frequency intersections between Alternative D area and Alternatives 2, 3 and 4.	***LSI*** Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***LSI*** Travel distance between sites is relatively long. 2 high-crash frequency intersections between Alternative D area and Alternative 5. Traffic improvements were completed in 2012.	***LSI*** Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***LSI*** Same as described for Alternative A or B/ Alternative 1.	***LSI*** Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***LSI*** Same as described for Alternative A or B/ Alternatives 2, 3, or 4.	***LSI*** Added traffic in areas with no sidewalks would increase the potential that bikers and pedestrians may be involved in a collision. ***LSI*** Same as described for Alternative A or B/ Alternatives 5.
Environmental Justice and the Protection of Children											
No additive Environmental Justice impacts under any combination of alternatives.											

Legend: ***SI*** = significant impact; ***SI-M*** = significant impact-mitigable; ***LSI*** = less than significant; ***NI*** = no impact; ***BI*** = beneficial impact.

6.2 COLLECTIVE IMPACTS INCLUDING 2010 ROD-RELATED ACTIONS



Collective impacts refer to the impacts of the entire Marine Corps relocation to Guam, and comprise those impacts resulting from implementation of the proposed action combined with the 2010 ROD-Related Actions not affected by the 2012 Roadmap Adjustments. Such collective impacts would customarily be presented as part of a traditional cumulative impacts analysis, which considers the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable projects. This SEIS, however, presents these impacts in this manner to further the public's understanding of the total direct, indirect, and cumulative impacts resulting from the proposed relocation. This collective impacts analysis facilitates both the analysis of the mitigation associated with the overall relocation effort and the development of associated environmental compliance documentation and consultations, such as those required under section 7 of the ESA. While this presentation of collective impacts represents a departure from the customary organization of an EIS, procedurally it represents the first step in the required cumulative impacts analysis for this SEIS (Chapter 7).

6.2.1 2010 ROD-Related Actions

The 2010 ROD-Related Actions that were not affected by the 2012 Roadmap Adjustments were discussed in detail in the 2010 Final EIS (Volume 1, Chapter 2: Overview of Proposed Actions and Alternatives, Section 2.2: Marine Corps Relocation - Guam, pages 2-7 through 2-17), and are summarized below in Table 6.2.1-1.

Table 6.2.1-1. 2010 ROD-Related Actions

Location	*Action*	*Description*	*Area (acres [ha])*
AAFB	Beddown of the Marine Corps ACE and construction of associated facilities at AAFB North Ramp	Will accommodate helicopter and other vertical lift aviation assets, operations, maintenance, and related training and support functions.	69.0 acres (27.9 ha)
	Construction of air embarkation facilities at AAFB South Ramp	Will include the Air Mobility Campus, Organic Marine Corps Cargo, Air Freight Terminal Complex, and New Passenger Terminal.	28.0 acres (11.3 ha)
	Construction of the North Gate and access road at AAFB, including a new Entry Control Point facility	Will improve traffic flow and physical security of vehicles entering and exiting the air base.	1.8 acres (0.7 ha)
Andersen South	Development of a non-firing training range complex to include maneuver training and landing zones	Will include facilities for military operations on urban terrain and maneuver training, including a Breacher House. Will also include landing zones to support training in Confined Area Landing, External Loads, and Helicopter Insertion/Extraction.	2,000.0 acres (809.4 ha) 155.7 acres (63.0 ha) of clearing/grading
Apra Harbor	Waterfront functions at Apra Harbor to support embarkation, including wharf and utility upgrades, and associated dredging and dredge disposal management	Berths and adjacent support structures and lay-down areas will be upgraded to accommodate increased usage and to meet the new and emerging requirements in support of the Marine Corps relocation. Requirements include embarkation operations, support vessel transport berthing, escort ship berthing, and an amphibious vehicle laydown area. Dredging will be required to accommodate some of the escort ships.	268.9 acres (108.8 ha) 172.2 acres (69.7 ha) currently developed (will be upgraded)
	Relocation of Military Working Dog Kennel	Existing dog kennel and administration spaces will be relocated because noise of embarkation will be incompatible with the existing uses as a military working dog kennel and training location.	2.0 acres (0.8 ha)
	Relocation of U.S. Coast Guard	Ship berthing and crew support buildings will be relocated to the former Ship Repair Facility because ships carrying amphibious vessels will require the full length of Victor Wharf.	11.0 acres (4.5 ha) Currently developed, no impact
	New Medical Clinic	A new medical/dental clinic will accommodate, in part, the increase in on-island military population.	7.8 acres (3.1 ha) Currently developed, will be graded
NAVMAG	Training activities, including aviation training and non-firing operations training	Will include maneuver training areas and landing zones to support training in Confined Area Landing, External Loads, and Helicopter Insertion Extraction.	3,253.1 acres (1,316.5 ha) 13.6 acre (5.5 ha) clearing/grading
	Access to the NAVMAG area using the existing hiking trail as the access road	The existing hiking trail will be used to access NAVMAG. The trail will not be improved and will be used by foot traffic only.	0.0 acres (0.0 ha)
	Use of Parsons Road area for the location of additional ammunition storage at NAVMAG	Earth-covered magazines will be located at the existing munitions storage area.	8.8 acres (3.6 ha)

Table 6.2.1-1. 2010 ROD-Related Actions

Location	*Action*	*Description*	*Area (acres [ha])*
Roadway Projects	Route 1 and Route 8 intersection and improvement (Hagåtña) (Guam Road Network [GRN]1)	Intersection improvements (0.24 mile [0.24 km]) on Route 1 and (0.09 mile [0.14 km] on Route 8) to provide two left-turn lanes and two right-turn lanes for northbound Route 8 approaching Route 1.	0.0 acre (0.0 ha)
	Route 1 and Route 3 intersection and roadway improvements (Dededo) (GRN2)	Intersection improvements (0.15 mile [0.39 km]) on Route 1 and (0.04 mile [0.06 km] on Route 3) to provide southbound left, combined left/right, and free right with acceleration lane; east to north double left-turn lane.	0.0 acre (0.0 ha)
	Replacement of Hagåtña (Agaña) Bridge #1 with reinforced concrete (GRN3)	Agaña Bridge replacement.	0.2 acre (0.06 ha)
	Route 11 roadway improvements from the port to Route 1, including pavement strengthening (GRN4)	Pavement strengthening of two lanes.	0.0 acre (0.0 ha)
	Widening of the Route 1 and Route 11 intersection, adding a second left turn lane and pavement strengthening (GRN5)	Intersection improvements (0.12 mile [0.19 km]) on Route 1.	0.0 acre (0.0 ha)

The following sections summarize the impacts to each resource from the 2010 ROD-Related Actions listed above and discussed in Volume 2 of the 2010 Final EIS. Impacts in the following sections are discussed in the future tense although it should be noted that some impacts resulting from construction and operations are occurring, or may have already occurred.

6.2.1.1 Geological and Soil Resources

As discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 3: Geological and Soil Resources, Section 3.2.2: Alternative 1, pages 3-34 to 3-49; Volume 6: Related Actions, Chapter 5: Geological and Soil Resources, Section 5.2.6.2: Alternative 2, pages 5-19 to 5-20), construction activities will include clearing, grading and grubbing, demolition of existing road pavement, earthwork, and landscaping on a total of approximately 383.6 acres (155.2 ha). Cut soil will be used as fill material whenever possible to minimize impacts to soil. Soil types that will be disturbed are not agriculturally productive, and BMPs will be utilized to minimize soil erosion. Proposed developments are located on relatively flat areas that are not subject to slope instability. There will be no adverse impacts to the sinkhole at North Ramp. Established procedures will be implemented to minimize topsoil loss, compaction, and erosion from training activities.

6.2.1.2 Water Resources

As discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 4: Water Resources, Section 4.2.2: Alternative 1, pages 4-84 to 4-118) there will be no direct impacts to surface waters or wetlands. Construction activities will result in the potential for an increase in stormwater runoff, erosion, and sedimentation, and the increase in impervious area will result in a minor increase in stormwater intensities and volume. LID measures and BMPs will be implemented to protect surface water and groundwater quality. There will be direct impacts to nearshore waters from the wharf improvement projects at Apra Harbor, and nearshore water quality will be temporarily impacted during the dredging process in Inner Apra Harbor. In addition, construction activities at Apra Harbor could result in runoff

that could be transported to or directly released to nearshore waters. Strict adherence to all applicable legal requirements will reduce potential impacts to surface waters, groundwater, nearshore waters, and wetlands.

As discussed in the 2010 Final EIS (Volume 6: Related Actions, Chapter 6: Water Resources, Section 6.2.6.2: Alternative 2, page 6-34), construction activities associated with the Hagåtña (Agaña) Bridge #1 replacement will cause an unavoidable loss of 0.2 acre (0.06 ha) of waters of the U.S. However, this impact will be minimized through (1) use of construction and source control BMPs cooperatively developed by FHWA and GEPA, and (2) improved hydraulic conveyance under the proposed bridge/box culvert replacement, which will serve to reduce erosion and sedimentation downstream. Through the development and implementation of site-specific construction BMPs, coordination with regulatory agencies, and adherence to applicable orders, laws, and regulations relating to water quality, construction activities will result in less than significant impacts to surface water, groundwater, and nearshore waters. In the operational phase, no impacts to floodplains are anticipated. Diversion of drainage from one watershed to another will be avoided. Roadway-specific BMPs will be included in the project planning, design, and construction. All operations will be implemented in accordance with all applicable federal, local, and military orders, laws, and regulations. Therefore, impacts to surface water, groundwater, and nearshore waters from the 2010 ROD-Related Actions will be less than significant.

6.2.1.3 Air Quality

As discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 5: Air Quality, Section 5.2.2: Alternative 1, pages 5-18 to 5-29; Volume 6: Related Actions, Chapter 7: Air Quality, Section 7.2.6.3: Alternative 2, pages 7-48 to 7-54), construction and operation of the facilities will result in air emissions. Construction emissions will include SO_2, CO, PM_{10}, $PM_{2.5}$, NO_x, VOC, and CO_2; however, construction will be short-term and localized. Aircraft and helicopter engines emit criteria pollutants during all phases of operation. There will also be vehicle emissions during training exercises. Air emissions associated with both construction and operation of the 2010 ROD-Related Actions will be well below the significance criteria of 250 tpy for all criteria air pollutants.

6.2.1.4 Noise

The 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 6: Noise, Section 6.2.2: Alternative 1, pages 6-23 to 6-42; Volume 6: Related Actions, Chapter 8: Noise, Section 8.2.6.1: Alternative 1, pages 8-12 to 8-40) discusses noise impacts from construction and operation of the 2010 ROD-Related Actions. Construction noise will be temporary, and heavy equipment that will generate the highest noise levels will not be used consistently enough to exceed the USEPA guidance level of 75 dBA for more than one hour beyond DoD installation boundaries. Additionally, terrain and distance from construction activities will lessen noise impacts to sensitive receptors outside of the construction areas. There may be localized noise for brief periods from temporary increases in truck traffic, but there will not be an adverse noise impact to human health, neighboring communities, or within installations. Airfield operations will increase noise for some additive residences within the 60-70 dBA DNL zones, but there will not be a significant impact to human health or hearing. Non-firing training will include new sources of ground-based noise from vehicle use on existing roads, the convoy course, and the Advanced Motor Vehicle Operator's Course in the maneuver training area, but these noise characteristics are similar to standard commercial vehicles. Most maneuver training will occur within the core of the maneuver training area, and noise setbacks will be established along the boundaries with the urban interface. Abatement measures for noise impacts associated with roadway projects are included as part of the project, where feasible.

6.2.1.5 Airspace

As discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 7: Airspace, Section 7.2.2: Alternative 1, pages 7-13 to 7-15), there will be an increase in total aircraft based at AAFB as well as associated aircraft operations. However, there will be no change to any of the approach and departure patterns associated with the airports/airfields at AAFB. The existing SUA will be used to conduct aircrew flight training, and low level training routes and landing zones will be established over Guam following VFR rules and procedures, and will not impact established flight paths. There will be no restrictions on access to, and no effect on, the use of Guam International Airport. In addition, there will be no effect on airport or airfield arrival and departure traffic flows due to the increase in military aircraft.

6.2.1.6 Land and Submerged Land Use

All of the non-roadway 2010 ROD-Related Actions will be constructed and operated at existing DoD facilities (2010 Final EIS, Volume 2: Marine Corps - Guam, Chapter 8: Land and Submerged Land Use, Section 8.2.3: Alternative 1, pages 8-59 to 8-75). There will be no change in land or submerged land use, no new public access restrictions, and all activities are consistent with land and submerged land use plans. Impacts from construction of the roadway projects, as discussed in the 2010 Final EIS (Volume 6: Related Actions, Chapter 10: Land and Submerged Land Use, Section 10.2.6.1: Alternative 1, page 10-12) will be typical of a public works maintenance project, with occasional disruption to business/commercial and tourist facilities. A Traffic Management Plan will be developed for implementation during construction activities.

6.2.1.7 Recreational Resources

As discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 9: Recreational Resources, Section 9.2.2: Alternative 1, pages 9-19 to 9-26; Volume 6: Related Actions, Chapter 11: Recreational Resources, Section 11.2.6.2, pages 11-9 to 11-10), construction of the 2010 ROD-Related Actions will result in an increase in construction-related vehicles on the roadways. This increase may cause delay for persons attempting to gain access to recreational resources. Construction activities will be short-term and localized. A Traffic Management Plan will be developed for implementation during roadway construction activities. All airfield and training operations will occur on DoD property. The training area at Andersen South will result in the loss of use of the Andersen South roads by joggers and walkers by fencing off the property and the addition of gates, however this resource is not unique to the region and there are comparable resources available in the adjoining properties.

6.2.1.8 Terrestrial Biological Resources

As discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 10: Terrestrial Biological Resources, Section 10.2.2: Alternative 1, pages 10-90 to 10-169), a total of 7.5 acres (3 ha) of primary limestone forest and 131 acres (53 ha) of secondary or disturbed limestone forest at AAFB will be removed. However, much of this forest area is not contiguous (i.e., the sum of the impacted forested area is from a number of different projects that are not collocated) or is adjacent to developed and previously disturbed areas.

As discussed in the 2010 Final EIS (Volume 6: Related Actions, Chapter 12: Terrestrial Biological Resources, Section 12.2.6.1: Alternative 1, pages 12-36 to 12-42), negligible direct impacts to aquatic habitats (approximately 0.15 acres [0.06 ha]) would occur from the replacement of Hagåtña Bridge #1 with reinforced concrete. Indirect impacts to aquatic habitats would be limited to potential sedimentation along the 260 feet (79 m) between the bridge and the river's terminus. Impacts to potential habitat for special-status species from the 2010 ROD-Related Actions are not significant.

Construction activities will displace wildlife from potentially suitable habitat in the project areas; however, construction activities are short-term and localized, and displaced species are abundant and are expected to repopulate suitable portions of the project areas upon completion of construction.

No vegetation will be cleared during training operations. In addition, with implementation of established BMPs and mitigation measures identified in the 2010 Final EIS, the introduction or spread of invasive species is not anticipated.

6.2.1.9 Marine Biological Resources

As discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 11: Marine Biological Resources, Section 11.2.2: Alternative 1, pages 11-73 to 11-113) and as covered in the Marine Biological Opinion (USFWS 2010), the only direct impacts to marine biological resources would be associated with wharf improvement construction activities at Apra Harbor. Marine flora, invertebrates, and associated EFH will not be appreciably modified from existing conditions, and impacts will be short-term and minor. Increases of construction-related vessel movements could result in localized disturbance and displacement of fish species as a result of the potential for increased turbidity, increased benthic sedimentation, impacts to eggs and larvae in the upper water column, and seasonal disturbances to spawning coral reef and pupping scalloped hammerhead sharks. These impacts will be short-term, periodic, and localized. Green sea turtles will be protected by postponing in-water construction activities when green sea turtles are detected in the area. Additionally, green sea turtles are highly mobile and it is expected that dredging and pile driving activities will deter green sea turtles from closely approaching work areas.

Impacts to marine biological resources from roadway projects, as summarized in Table 13.2-8 of the 2010 Final EIS (Volume 6: Related Actions, Chapter 13: Marine Biological Resources, page 13-39), would include indirect impacts during construction and operation from increased runoff and potential for sedimentation of marine waters.

6.2.1.10 Cultural Resources

The 2010 ROD-Related Actions consist of construction at North Ramp, South Ramp, and a North Gate on AAFB, development of the non-firing training range complex at Andersen South, wharf upgrades and construction at Naval Base Guam, and construction of ammunition magazines and aviation training at the NAVMAG. These specific project areas were intensively investigated as described in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 12: Cultural Resources, Section 12.1, pages 12-1 to 12-38. The 2010 ROD-Related Actions, as discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 12: Cultural Resources, Section 12.2.2: Alternative 1, pages 12-41 to 12-54; Volume 6), would potentially affect 11 historic properties, including seven within the airfield and training areas at AAFB, two within NAVMAG, and two within the training areas at Andersen South (Table 6.2.1-2). No adverse effects would occur to historic properties at Apra Harbor or Naval Base Guam. No historic architectural properties eligible for the NRHP would be adversely affected. Less than significant impacts would occur due to the use of the existing foot trail at NAVMAG. There would be no impacts to TCPs or resources of cultural importance from the implementation of these actions.

Additional 2010 ROD-Related Actions include the five roadway projects along Route 1, which are discussed in Volume 6 of the 2010 Final EIS (Volume 6: Related Actions, Chapter 14: Cultural Resources, Section 14.2.6.1: Alternative 1, page 14-19). The intersection improvement and pavement strengthening projects would not impact cultural resources. Hagåtña (Agaña) Bridge is a historic property. However, the bridge will be reconstructed in its historic location, and mitigation will preserve the only

remaining historic attributes and features contributing to the bridge's NRHP eligibility; therefore, FHWA found that, with mitigation, the project will have no adverse effect on Hagåtña (Agaña) Bridge.

Table 6.2.1-2. Historic Properties Potentially Affected by the 2010 ROD-Related Actions

GHPI Number†	*Temporary Site Number/ Map Number*	*Site Type*	*Period*	*Reference*	*NRHP Eligible?*	*NRHP Criteria*
66-07-1064		North Field	Post-WWII/Second American Territorial	Salo and Mohlman 2012	Yes	A
66-07-2128	1010*	Concrete pads	Post-WWII/Second American Territorial	Grant *et al.* 2007	Yes	D
66-07-2319	T-9/1044*	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-07-2320	T-10/1045*	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-07-2321	T-11/1046*	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-07-2322	T-14/1049*	Ceramic scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-07-2323	T-NW-1/1050*	Ceramic scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-04-2324	AS-2007-T-7/1063*	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
66-04-2325	AS-2007-T-20/1065*	Artifact scatter	Pre-Contact/Latte	Welch 2010	Yes	D
	Site 43/80*	Habitation with *latte*	Pre-Contact/Pre-Latte/Latte	Henry *et al.* 1998	Yes	D
	Site 83/113*	Artifact scatter	Pre-Contact/Latte	Henry *et al.* 1998	Yes	D

Notes: †Not all sites recorded within the project areas have received official GHPI numbers, although they have been documented as part of previous surveys.
Source: *Welch *et al.* 2009.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements for the overall relocation action. Broadly, the 2011 PA includes processes to share information, consider views of the public, and develop mitigation measures when historic properties may be adversely affected.

More specifically, the 2011 PA established a process for the review and analysis of potential effects to historic properties and other cultural resources and provides measures for mitigating adverse effects to NRHP-eligible or listed archaeological sites, consulting on new projects and initiating additional identification efforts, and resolving impacts due to loss of access to areas of cultural significance or culturally important natural resources. To the degree possible, direct and indirect impacts to historic properties and natural resources of cultural importance would be avoided or minimized during the planning process. If avoidance is not possible, anticipated mitigation measures to resolve adverse effects to historic properties and reduce adverse impacts to cultural resources resulting from the implementation of the 2010 ROD-Related Actions include the following: (1) identifying and evaluating other properties as applicable, (2) developing a mitigation plan, (3) consulting with PA Signatories and Concurring Parties if requested, (4) conducting data recovery or other appropriate mitigation, (5) submitting data recovery or similar mitigation reports to SHPO for review before finalizing, (6) preparing public educational materials in English and Chamorro, and (7) enforcing construction contractor measures.

6.2.1.11 Visual Resources

The 2010 ROD-Related Actions will occur at existing DoD facilities and will not represent a major visual change from existing conditions (2010 Final EIS, Volume 2: Marine Corps - Guam, Chapter 13: Visual Resources, Section 13.2.2: Alternative 1, pages 13-62 to 13-69). Publicly accessible views into these areas are limited due to distance or dense vegetation.

Roadway projects, as discussed in the 2010 Final EIS (Volume 6: Related Actions, Chapter 15: Visual Resources, Section 15.2.6.1: Alternative 1, pages 15-8 to 15-26) will not have an adverse impact on the existing visual environment. Replacement of the Hagåtña (Agaña) Bridge will include mitigation measures that address the aesthetics of the bridge, which will increase the visual quality.

6.2.1.12 Ground Transportation

Impacts to ground transportation from implementation of the 2010 ROD-Related Actions will be limited to the construction period. There may be potential temporary congestion associated with the delivery of construction materials and equipment, removal of construction debris, and parking for construction workers. Construction will be short-term, temporary, and localized. A Traffic Management Plan will be developed for implementation during roadway construction activities.

6.2.1.13 Marine Transportation

As discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 14: Marine Transportation, Section 14.2.2: Alternative 1, pages 14-10 to 14-15) additional container and break-bulk cargo ships will be required to transport equipment and supplies necessary for the construction of the 2010 ROD-Related Actions. Additionally, the dredging of Sierra Wharf will require transportation of dredged material over a period of 6 to 9 months. There has been a steady and substantial decline in the number of commercial vessels visiting the Port of Guam from 1995 through 2012. The number of vessels associated with the 2010 ROD-Related Actions is well below the total number of vessels visiting the Port of Guam in 1995, which had the highest number of vessel visits between 1995 through 2012. As the additional number of vessels is much less than the difference between the number of current (2012) vessel visits and the number of vessel visits in 1995, there will be no impacts to marine transportation from construction of the 2010 ROD-Related Actions.

6.2.1.14 Utilities

As discussed in the 2010 Final EIS (Volume 1: Overview of Proposed Actions and Alternatives, Chapter 2: Overview of Proposed Actions, Section 2.2: Marine Corps Relocation - Guam, pages 2-7 to 2-17), the 2010 ROD-Related Actions not affected by the 2012 Roadmap Adjustments will require localized and relatively small increased demand for utilities.

Primary utility needs will be local to Apra Harbor. The total utility requirements for the 2012 Roadmap Adjustments proposed action, including those from the 2010 ROD-Related Actions, have been included in the SEIS utilities assessments. Utilities will be installed at facilities using BMPs and standard construction and operation procedures and requirements to minimize impacts to existing utilities. The existing utilities can accommodate the additional usage at the new facilities.

6.2.1.15 Socioeconomics and General Services

The 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 16: Socioeconomics and General Services, Section 16.2.2: Proposed Action and Section 16.2.3: Land Acquisition Impacts, pages 16-73 to 16-147) assesses impacts based on an increase in population and land acquisition. There will be no increase in population attributable specifically to construction and operation of the 2010 ROD-Related Actions. Additionally, the 2010 ROD-Related Actions will not require land acquisition.

6.2.1.16 Hazardous Materials and Waste

As discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 17: Hazardous Materials and Waste, Section 17.2.2: Alternative 1, pages 17-38 to 17-55), construction of the 2010 ROD-Related Actions will result in the use and disposal of more hazardous materials. There is the potential for an inadvertent spill, release, or leak of hazardous materials. Hazardous materials will be handled and disposed of per applicable BMPs and SOPs.

6.2.1.17 Public Health and Safety

As discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 18: Public Health and Safety, Section 18.2.2: Alternative 1, pages 18-13 to 18-23; Volume 6: Related Actions, Chapter 19: Public Health and Safety, Section 19.2.9.1: Alternative 1, pages 19-17 to 19-18), there may be impacts associated with UXO and traffic accidents, as well as impacts to noise, water quality, and air quality. These impacts will be minimal and will be limited primarily to the construction period, which will be short-term and localized. UXO may be encountered during construction or during operations.

Training activities associated with the 2010 ROD-Related Actions have minimal potential to impact public health and safety. The public will be notified prior to training activities, and all training activities will occur within established on-base training areas. Specific and documented procedures will be implemented to reduce the potential for interaction between the public and training personnel and to ensure that the public is not endangered by training activities.

6.2.1.18 Environmental Justice and the Protection of Children

As discussed in the 2010 Final EIS (Volume 2: Marine Corps - Guam, Chapter 19: Environmental Justice and the Protection of Children, Section 19.2.2: Alternative 1, pages 19-11 to 19-18; Volume 6: Related Actions, Chapter 20: Environmental Justice and the Protection of Children, Section 20.2.8: Summary of Impacts, page 20-20), there will be an increase in construction-related noise, traffic, and safety concerns during construction of the 2010 ROD-Related Actions. These impacts will be short-term, temporary, and localized, and will not disproportionately impact minority or low-income populations or children. A Traffic Management Plan will be prepared and implemented during roadway construction. Completion of the roadway projects will have a beneficial impact due to improved and safer roadway infrastructure.

6.2.1.19 Summary of Impacts Associated with the 2010 ROD-Related Actions

Table 6.2.1-3 summarizes the potential impacts to each resource from the 2010 ROD-Related Actions.

Table 6.2.1-3. Summary of Potential Impacts from Implementation of the 2010 ROD-Related Actions

Resource	*Impact*
Geological and Soil Resources	Total disturbed acreage from construction is approximately 383.6 acres (155.2 ha). There is one sinkhole in the vicinity of the North Ramp that will not be adversely impacted.
Water Resources	BMPs will be utilized to minimize the indirect impacts to groundwater and surface water. There will be no loss of wetlands. There will be direct but temporary impacts to nearshore waters from dredging at Inner Apra Harbor.
Air Quality	Increase in emissions, including SO_2 and hot spot PM, CO, and MSATs concentrations, will be below applicable impact significance thresholds.
Noise	Construction noise will be temporary and will be within existing DoD property boundaries. Noise from airfield operations and training functions will not have a significant or adverse impact to human health or hearing.
Airspace	There will be an increase in total aircraft based at AAFB and associated aircraft operations; however, there will be no change to any of the approach and departure patterns associated with the airports/airfields at AAFB and there will be no restrictions on access to, and no effect on the use of Guam International Airport Route There will be no measurable change in airspace requirements or management procedures.
Land and Submerged Land Use	Activities are compatible with existing land uses. No significant impacts identified for airfield activities, non-firing training, or waterfront activities.
Recreational Resources	During construction, there may be increased traffic congestion due to the presence of construction vehicles. Noise generated from proposed training activities will be consistent with noise from existing operations and will not diminish user experience at recreational areas.
Terrestrial Biological Resources	Clearing of a total of 384 acres (155 ha) of vegetation, 7.5 acres (3 ha) of which is primary limestone forest at AAFB. Disturbance to and loss of habitat for special-status species. With implementation of established BMPs and mitigation measures identified in the 2010 Final EIS, the introduction or spread of invasive species is not anticipated.
Marine Biological Resources	No direct impacts to special-status species will occur, although indirect impacts could occur because of increased marine traffic associated with delivery of construction materials and equipment. Impacts to EFH would be short-term and localized.
Cultural Resources	Direct adverse effects to 11 historic properties.
Visual Resources	Facilities will be within existing DoD properties and will not represent a major change over the existing visual conditions.
Ground Transportation	Potential temporary congestion associated with the delivery of construction materials and equipment, removal of construction debris, and parking for construction workers.
Marine Transportation	The number of vessels associated with the 2010 ROD-Related Actions is well below the total number of vessels visiting the Port of Guam in 1995.
Utilities	The 2010 ROD-Related Actions not affected by the 2012 Roadmap Adjustments will require localized and relatively small increased demand for utilities. Primary utility needs will be local to Apra Harbor. During construction, BMPs and standard construction and operation procedures and requirements will minimize impacts of utilities installation.
Socioeconomics and General Services	There will be no population increase. There will be no sociocultural or land acquisition impacts.
Hazardous Materials and Waste	The use of hazardous materials will be handled and disposed per applicable BMPs and SOPs.
Public Health and Safety	There will be minimal impacts from UXO and traffic accidents, and to noise, water quality, and air quality during construction. There will be no public health and safety impacts from training and airfield operations.
Environmental Justice and the Protection of Children	Increased construction noise, traffic, and associated safety concerns will not disproportionately impact minority, low-income, or children populations.

6.2.2 Resources with No Additional Collective Impact from the 2010 ROD-Related Actions

The 2010 Final EIS identified no impacts to the following resources from the 2010 ROD-Related Actions:

- Airspace
- Land and Submerged Land Use
- Visual Resources
- Socioeconomics and General Services

Therefore, the impacts of the proposed action (as described in Chapters 4 and 5 and Section 6.1) represent the total collective impacts of the Marine Corps relocation for these resources, and they are not discussed further in this section.

6.2.3 Resources with Collective Impacts Common to All Alternative Site Combinations

Several additional resources would be subject to collective impacts associated with the proposed action and the 2010 ROD-Related Actions, but the impacts would not be uniquely related to alternative site combinations. Many of these collective impacts are associated with the construction phase, which would result in short-term, localized impacts. An analysis of the collective impacts associated with implementation of the proposed action (regardless of selected alternative site combinations) and the 2010 ROD-Related Actions is presented below.

6.2.3.1 Geological and Soil Resources

Collective impacts to soil resources would result from the increased acreage of disturbance, including clearing, grading and grubbing, earthwork, and landscaping. BMPs would be utilized to minimize soil erosion. Therefore, the collective impact to soil resources would be less than significant.

There are numerous sinkholes and depressions identified, as well as the potential for sinkholes and depressions at several of the proposed alternative locations. There is one sinkhole identified at North Ramp. For any sinkholes discovered before or during construction, BMPs would include compliance with the requirements of 22 GAR Chapter 10, § 10106. With implementation of these BMPs, no adverse impacts from sinkholes would occur due to construction. Therefore, the collective impact associated with sinkholes and depressions would be less than significant.

There would not be a collective impact on topography. Although the 2010 ROD-Related Actions include clearing, grading and grubbing, demolition of existing road pavement, earthwork, and landscaping on a total of approximately 383.6 acres (155.2 ha), there would not be a significant amount of cut and fill that would permanently alter the topography of the area. Although there is not a collective impact to topography, impacts to topography remain significant due to the amount of cut and fill at the LFTRC alternatives.

6.2.3.2 Water Resources

Neither the proposed action nor the 2010 ROD-Related Actions would directly impact surface waters or wetlands; therefore, there would be no collective direct impact to these resources. Although there would be direct impacts to nearshore waters for the 2010 ROD-Related Actions, there would be no direct impacts to nearshore waters from construction or operation of the proposed action; thus, the collective direct impact to nearshore waters would result only from the ROD-Related Actions.

Stormwater runoff protection measures, including compliance with Construction General Permit requirements and other regulations and implementation of BMPs, LID, and a Program SWPPP and site-specific SWPPPs, would minimize the collective indirect impacts. Groundwater demand from the NGLA

would be substantially less than the sustainable yield, but there would be localized significant impacts to the NGLA that would be mitigated, as well as less than significant impacts to the overall NGLA. Induced civilian and construction/DoD workforce growth during construction and operation of the proposed action would increase demand for wastewater treatment and disposal of generated wastewater. This would result in significant short-term indirect collective impacts to nearshore waters during the construction phase, but upgrades to the currently non-compliant WWTP(s) treatment systems (as required by their current NPDES permits) would mitigate indirect impacts during operation to less than significant.

6.2.3.3 Air Quality

Since the analysis described in Chapters 4 and 5 was performed for the maximum potential adverse effect, the forecasts of location-specific traffic and construction activities impacts would remain representative under this and other combined alternatives. Therefore, the localized mobile source concentration collective impacts would be less than significant.

6.2.3.4 Recreational Resources

Collective impacts to recreational resources from implementation of the proposed actions and the 2010 ROD-Related Actions could result from both the increase in the workforce and associated increased use of recreational resources during the construction phase. During construction there may be increased traffic congestion that delays access to recreational resources due to the presence of construction vehicles. However, there are no additional operational impacts beyond those discussed in Chapter 4. Any hindrance of access caused by construction activities would be short-term and localized, and the collective impacts to recreational resources would be less than significant.

6.2.3.5 Marine Biological Resources

Although there are direct impacts related to construction in Inner Apra Harbor for the 2010 ROD-Related Actions, the proposed action would not create any additional collective impact.

Total vessel traffic is not anticipated to exceed historical maximum levels, and BMPs would be implemented to minimize impacts to water quality from vessel operations. Therefore, the collective impacts to marine biological resources would be less than significant.

However, consultation with the NMFS under section 7 of the ESA was concluded on the entire proposed action including the remaining proposed construction in inner Apra Harbor associated with the 2010 Final EIS and the proposed action included in this Final SEIS. The DON previously completed a consultation related to the Guam and CNMI Military Relocation EIS in 2010, and the DON continues to operate under the 2010 BO for the listed marine species addressed under that consultation (i.e., sea turtles). However, since completion of the 2010 consultation, the threatened scalloped hammerhead shark and three species of threatened coral (*Acropora globiceps*, *Acropora retusa*, and *Seriatopora aculeata*) that may occur within the project area have been listed. The DON determined that these newly listed species could occur in the vicinity of the proposed action, and accordingly, the DON requested a reinitiation of informal consultation to address potential effects to these newly listed species. Consultation with the NMFS concluded with a letter of concurrence on May 18, 2015. The NMFS considered the information in the DON's EIS/OEIS (2010), the Draft SEIS (2014), and consultation requests, as well as the best scientific information available about the biology and expected behaviors of the ESA-listed marine species and agreed with the DON conclusion that the proposed action is not likely to adversely affect scalloped hammerhead sharks or the three ESA-listed corals. NMFS also agreed that the proposed action would have no effect on critical habitat. NMFS provided five conservation recommendations that they deemed prudent to include in their letter of concurrence. The DON will consider adoption of one or more of these

conservation recommendations and will address them in the ROD for this proposed action.

6.2.3.6 Ground Transportation

As discussed in Section 6.2.1.12, impacts to ground transportation from implementation of the 2010 ROD-Related Actions will be limited to the construction period. During the construction period, temporary and intermittent transportation impacts would result from truck movements, as well as construction worker vehicles traveling to and from the site. Construction-related impacts generally would not be considered significant due to their temporary nature and limited, finite duration. Therefore, any collective impact to ground transportation from implementation of the proposed action and the 2010 ROD-Related Actions would be less than significant.

6.2.3.7 Marine Transportation

Implementation of the proposed action and the 2010 ROD-Related Actions concurrently would increase the amount of vessel traffic in Apra Harbor during construction. The combined total number of predicted vessel visits to Apra Harbor during construction is 514 vessel visits (127 barges of dredge spoils + 387 cargo ships [242 breakbulk +145 containers]). This, combined with the predicted number of background vessel visits within the range of analysis shown in Section 4.1.13, would not exceed the recent maximum number of annual vessel visits (in FY 1995). Because the annual number of vessels visiting the Port of Guam has decreased by 2,289 vessels over the period of FY 1995 to FY 2012, it is expected that the additional predicted annual number of vessels visiting the Port of Guam would result in a less than significant impact on marine transportation. Therefore, the collective impact from construction of the proposed action and the 2010 ROD-Related Actions would be less than significant.

6.2.3.8 Utilities

Utility demands associated with the proposed action are primarily associated with the cantonment/family housing alternatives. To meet these demands, the proposed action included development of a well field and upgrades to electrical lines, as discussed in Section 2.2.3. Utility demands resulting from implementation of the 2010 ROD-Related Actions, LFTRC alternatives, and cantonment/family housing alternatives are of the same magnitude regardless of alternative, and would be met by the existing utility infrastructure and utility upgrades associated with the proposed action. Therefore, the collective impact to utilities from implementation of the proposed action and the 2010 ROD-Related Actions would be less than significant.

6.2.3.9 Hazardous Materials and Waste

As discussed in Section 6.2.1.16, construction of the 2010 ROD-Related Actions will result in an increase in the use of hazardous materials and disposal of hazardous waste. To avoid inadvertent hazardous substance spills, releases, or leaks, hazardous materials will be used and disposed of in accordance with applicable SOPs and BMPs. The proposed action would also result in an increase in the use of hazardous materials and disposal of hazardous waste regardless of location. With implementation of BMPs and SOPs, the collective impact associated with the use, storage, and disposal of hazardous materials and waste would be less than significant.

6.2.3.10 Public Health and Safety

Collective impacts associated with construction of the proposed action and the 2010 ROD-Related Actions could occur during periods when there would be overlap in construction. The increase of the civilian workforce that would potentially occur regardless of action alternative may create a collective impact to health care services, as well as impacts associated with UXO, traffic accidents, noise, water quality, and air quality. This collective impact would be limited to the construction period, which would be short-term and localized. Therefore, the collective impact to public health and safety during construction would be less than significant.

6.2.3.11 Environmental Justice

Collective impacts associated with construction of the proposed action and the 2010 ROD-Related Actions could occur during periods when there would be overlap in construction. As discussed above in Public Health and Safety, the increase of the civilian workforce may create a collective impact to health care services, which would disproportionately impact low-income populations. Construction would be short-term and localized; therefore, the collective impacts would be less than significant.

6.2.4 Collective Impacts Associated with Unique Site Combinations

Collective impacts include the combination of the impacts discussed for each of the cantonment/family housing alternatives, the LFTRC alternatives, and the impacts associated with the 2010 ROD-Related Actions. This section provides an analysis of potential collective impacts of different combinations of site alternatives (i.e., Alternatives A through D for cantonment/family housing and Alternatives 1 through 5 for the LFTRC) and the impacts of the 2010 ROD-Related Actions. The resource areas that would be affected by collective actions associated with unique site combinations are Noise, Terrestrial Biological Resources, and Cultural Resources. The subsections below provide a comparison of the collective impacts to Noise, Terrestrial Biological Resources, and Cultural Resources associated with the unique site combinations and the 2010 ROD-Related Actions.

6.2.4.1 Noise

Collective noise impacts would be limited to those associated with the LFTRC. Alternative 1 is located in the same geographic region as Andersen South. Noise-producing activities at Andersen South include aviation training, military operations on urban terrain training, breacher house training, use of the HG range, and convoy training. However, the noise contours generated by the 2010 ROD-Related Actions do not overlap with the LFTRC contours. Therefore, the collective noise impact associated with the 2010 ROD-Related Actions and the combination of any of the cantonment/family housing alternatives with Alternative 1 would be less than significant.

Collective impacts would also occur from implementation of any of the three NAVMAG LFTRC alternatives (Alternative 2, 3, or 4) due to the noise-generating activities of the 2010 ROD-Related Actions occurring at NAVMAG, coupled with the LFTRC noise from Alternatives 2, 3, or 4. Noise producing activities include aviation and ground-based training. However, the noise contours generated by the 2010 ROD-Related Actions do not overlap with the LFTRC contours. Therefore, the collective noise impact associated with the 2010 ROD-Related Actions and the combination of any of the cantonment/family housing alternatives with any of the NAVMAG LFTRC alternatives would be less than significant. Collective impacts would also occur due to the noise generating activities of the 2010 ROD-Related Actions occurring at NWF (aircraft operations) coupled with the LFTRC noise from Alternative 5. In addition, ground-based training at NWF (use of the demolition range where Marine Corps and Air Force units detonate cratering charges) would also contribute to collective noise impacts.

Figure 6.2.4-1 shows noise contours for aviation training, the demolition range, and the LFTRC. The aviation and LFTRC noise would not overlap at any location off-base. The demolition noise contours and the LFTRC noise contours overlap, but the "average busy day" noise generated by the demolition range contours only occurs twice per year. Therefore, the collective impact associated with the 2010 ROD-Related Actions and the combination of any of the cantonment/family housing alternatives with Alternative 5 would be less than significant.

6.2.4.2 Terrestrial Biological Resources

The collective impacts due to implementation of the cantonment/family housing alternatives, LFTRC alternatives, IT/COMM lines, and the 2010 ROD-Related Actions would be equal to the combined effects and impacts of each. Terrestrial biological resources investigations for these actions are discussed in Sections 6.1, 6.2.1.8, and Chapters 4 and 5. A summary of the collective impact to terrestrial biological resources is provided in Table 6.2.4-1. Comparisons of the potential alternative combinations are discussed below.

Alternative C and Alternative 1 would have the greatest total impacts to limestone forest (primary and secondary combined): 1,485 acres (601 ha). This would be approximately 8% of the limestone forest found on federal lands on Guam. Similarly, Alternative C, combined with Alternatives 5, 3, and 4 would have the next greatest impacts to limestone forest, at 1,431 acres (579 ha), 1,399 acres (566 ha), and 1,360 acres (550 ha), respectively. Any combination of alternatives that include Alternative D would have the lowest total impact to limestone forest, and Alternative D combined with Alternative 2 would have the lowest impact: 316 acres (128 ha). This would be approximately 1.7% of the limestone forest found on federal lands on Guam. No significant impacts to limestone forest would occur with implementation of the ITT/COMM infrastructure portion of any alternative combination.

With respect to Overlay Refuge lands, any combination of alternatives that include Alternative A would have the greatest potential impact. Specifically, Alternative A with Alternative 3 would have the greatest total impact to Overlay Refuge lands at 1,608 acres (651 ha), or 7% of the lands. Similar to impacts to limestone forest, any combination of alternatives that include Alternative D would also have the lowest total impact to limestone forest. Specifically, Alternative D with Alternatives 1 or 2 would have the lowest impact at 153 acres (62 ha) or <1% of the lands.

All alternative combinations would have significant impacts to ESA-listed special-status species, and only six alternative combinations would not have significant impacts to Guam-listed special-status species: Alternatives C or D when combined with Alternatives 1, 2, or 5.

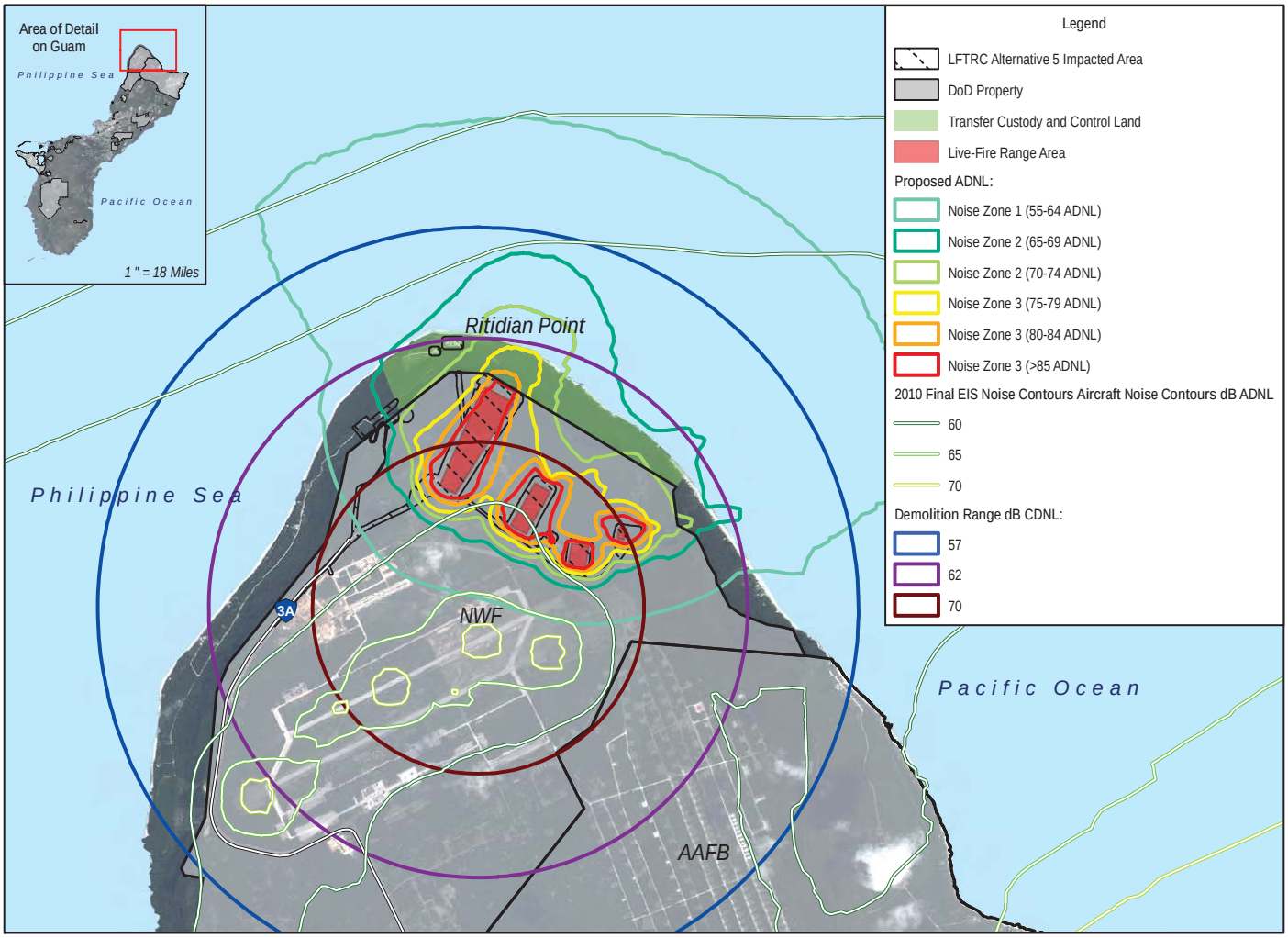


Figure 6.2.4-1
Collective Noise Contours at NWF

Table 6.2.4-1. Summary of Collective Impacts to Terrestrial Biological Resources by Alternative

Combination of Alternatives	*Primary Limestone Forest[1] (acres [ha])*	*Secondary Limestone Forest[1] (acres [ha])*	*Overlay Refuge[1] (acres [ha])*	*ESA-Listed Species[2]*	*Guam-Listed Species[2]*	*Recovery Habitat (acres [ha])*	*Critical Habitat (acres [ha])*
Finegayan Cantonment/Family Housing (Alternative A) with Route 15 LFTRC (Alternative 1)	71 (29)	1,205 (488)	1,326 (537)	GMK, GR, MC, MFB, Ser	MS, PSTG	MFB: 1,074 (435) MC: 1,075 (435) GR: 858 (355) GMK: 1,074 (435) Ser: 731 (296)	NA
Finegayan Cantonment/Family Housing (Alternative A) with NAVMAG East/West LFTRC (Alternative 2)	6 (3)	1,034 (418)	1,326 (537)	GMK, GR, MC, MFB, Ser	MS, PSTG	MFB: 1,036 (419) MC: 1,037 (419) GR: 686 (278) GMK: 1,036 (419) Ser: 682 (276)	NA
Finegayan Cantonment/Family Housing (Alternative A) with NAVMAG North/South LFTRC (Alternative 3)	111 (45)	1,079 (437)	1,601 (648)	GMK, GR, MC, MCM, MFB, Ser	MS, PSTG	MFB: 1,216 (492) MC: 1,217 (493) GR: 661 (268) GMK: 1,216 (492) Ser: 704 (285)	NA
Finegayan Cantonment/Family Housing (Alternative A) with NAVMAG L-Shaped LFTRC (Alternative 4)	73 (29)	1,078 (436)	1,545 (625)	GMK, GR, MC, MFB, Ser	MS, PSTG	MFB: 1,154 (467) MC: 1,160 (469) GR: 687 (278) GMK: 1,154 (467) Ser: 683 (276)	NA
Finegayan Cantonment/Family Housing (Alternative A) with NWF LFTRC (Alternative 5)	95 (39)	1,145 (463)	1,624 (657)	GMK, GR, MC, MFB, Ser	MS, PSTG	MFB: 1,208 (489) MC: 1,209 (489) GR: 719 (291) GMK: 1,208 (489) Ser: 841 (340)	MFB, MC, GMK: 12 (5)
Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with Route 15 LFTRC (Alternative 1)	71 (29)	1,017 (412)	1,030 (417)	GMK, GR, MC, MFB, Ser	MS, PSTG	MFB: 871 (353) MC: 872 (353) GR: 991 (401) GMK: 871 (353) Ser: 716 (290)	NA
Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with NAVMAG East/West LFTRC (Alternative 2)	6 (3)	846 (343)	1,030 (417)	GMK, GR, MC, MFB, Ser	MS, PSTG	MFB: 833 (337) MC: 834 (338) GR: 757 (306) GMK: 833 (337) Ser: 667 (270)	NA

Table 6.2.4-1. Summary of Collective Impacts to Terrestrial Biological Resources by Alternative

Combination of Alternatives	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Species[(2)]*	*Guam-Listed Species[(2)]*	*Recovery Habitat (acres [ha])*	*Critical Habitat (acres [ha])*
Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with NAVMAG North/South LFTRC (Alternative 3)	111 (45)	891 (361)	1,305 (528)	GMK, GR, MC, MCM, MFB, Ser	MS, PSTG	MFB: 1,013 (410) MC: 1,021 (413) GR: 732 (296) GMK: 1,013 (410) Ser: 689 (279)	NA
Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with NAVMAG L-Shaped LFTRC (Alternative 4)	73 (29)	890 (360)	1,249 (506)	GMK, GR, MC, MFB, Ser	MS, PSTG	MFB: 951 (385) MC: 957 (387) GR: 758 (307) GMK: 951 (385) Ser: 668 (270)	NA
Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with NWF LFTRC (Alternative 5)	95 (39)	957 (387)	1,328 (537)	GMK, GR, MC, MFB, Ser	MS, PSTG	MFB: 1,005 (407) MC: 1,006 (407) GR: 790 (320) GMK: 1,005 (407) Ser: 826 (334)	MFB, MC, GMK: 11 (5)
AAFB Cantonment/Family Housing (Alternative C) with Route 15 LFTRC (Alternative 1)	208 (84)	1,234 (499)	972 (394)	GMK, GR, MC, MFB, Ser	-	MFB: 1,270 (514) MC: 1,272 (515) GR: 651 (264) GMK: 1,270 (514) Ser: 1,182 (478)	NA
AAFB Cantonment/Family Housing (Alternative C) with NAVMAG East/West LFTRC (Alternative 2)	143 (58)	1,063 (430)	972 (393)	GMK, GR, MC, MCM, MFB, Ser	PSTG	MFB: 1,232 (499) MC: 1,275 (516) GR: 417 (169) GMK: 1,232 (499) Ser: 1,133 (459)	NA
AAFB Cantonment/Family Housing (Alternative C) with NAVMAG North/South LFTRC (Alternative 3)	248 (100)	1,108 (448)	1,247 (505)	GMK, GR, MC, MCM, MFB, Ser	PSTG	MFB: 1,412 (571) MC: 1,421 (575) GR: 392 (159) GMK: 1,412 (571) Ser: 1,155 (467)	NA
AAFB Cantonment/Family Housing (Alternative C) with NAVMAG L-Shaped LFTRC (Alternative 4)	210 (85)	1,107 (448)	1,191 (482)	GMK, GR, MC, MFB, Ser	PSTG	MFB: 1,350 (546) MC: 1,357 (549) GR: 418 (169) GMK: 1,350 (546) Ser: 1,134 (459)	NA

Table 6.2.4-1. Summary of Collective Impacts to Terrestrial Biological Resources by Alternative

Combination of Alternatives	*Primary Limestone Forest[1] (acres [ha])*	*Secondary Limestone Forest[1] (acres [ha])*	*Overlay Refuge[1] (acres [ha])*	*ESA-Listed Species[2]*	*Guam-Listed Species[2]*	*Recovery Habitat (acres [ha])*	*Critical Habitat (acres [ha])*
AAFB Cantonment/Family Housing (Alternative C) with NWF LFTRC (Alternative 5)	232 (94)	1,174 (475)	1,270 (514)	GMK, GR, MC, MFB, Ser	-	MFB: 1,404 (568) MC: 1,406 (569) GR: 450 (182) GMK: 1,404 (568) Ser: 1,292 (523)	MFB, MC, GMK: 11 (5)
Barrigada Cantonment/Family Housing (Alternative D) with Route 15 LFTRC (Alternative 1)	170 (69)	339 (137)	126 (51)	GR	-	MFB: 179 (72) MC: 179 (72) GR: 1,291 (522) GMK: 179 (72) Ser: 150 (61)	NA
Barrigada Cantonment/Family Housing (Alternative D) with NAVMAG East/West LFTRC (Alternative 2)	105 (42)	168 (68)	126 (51)	GR	-	MFB: 141 (57) MC: 141 (57) GR: 1,057 (428) GMK: 141 (57) Ser: 104 (42)	NA
Barrigada Cantonment/Family Housing (Alternative D) with NAVMAG North/South LFTRC (Alternative 3)	210 (85)	213 (86)	401 (162)	MCM, MFB, GR GMK, MCM	PSTG	MFB: 321 (130) MC: 328 (133) GR: 1,032 (418) GMK: 321 (130) Ser: 123 (50)	NA
Barrigada Cantonment/Family Housing (Alternative D) with NAVMAG L-Shaped LFTRC (Alternative 4)	172 (70)	212 (86)	345 (140)	MC, MFB, GR, GMK	PSTG	MFB: 259 (105) MC: 264 (107) GR: 1,058 (428) GMK: 259 (105) Ser: 102 (41)	NA
Barrigada Cantonment/Family Housing (Alternative D) with NWF LFTRC (Alternative 5)	194 (78)	279 (113)	424 (172)	MFB, MC, GMK, GR, Ser	-	MFB: 313 (127) MC: 313 (127) GR: 1,090 (441) GMK: 313 (127) Ser: 260 (105)	MFB, MC, GMK: 11 (5)
Finegayan Cantonment/AAFB Family Housing (Alternative E) with Route 15 LFTRC (Alternative 1)	71 (29)	977 (395)	1,148 (465)	MC, MFB, GR, GMK, Ser	PSTG, MS	MFB: 836 (338) MC: 837 (339) GR: 927 (375) GMK: 836 (338) Ser: 745 (301)	NA

Table 6.2.4-1. Summary of Collective Impacts to Terrestrial Biological Resources by Alternative

Combination of Alternatives	*Primary Limestone Forest[(1)] (acres [ha])*	*Secondary Limestone Forest[(1)] (acres [ha])*	*Overlay Refuge[(1)] (acres [ha])*	*ESA-Listed Species[(2)]*	*Guam-Listed Species[(2)]*	*Recovery Habitat (acres [ha])*	*Critical Habitat (acres [ha])*
Finegayan Cantonment/AAFB Family Housing (Alternative E) with NAVMAG East/West LFTRC (Alternative 2)	6 (2)	806 (326)	1,148 (465)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 798 (323) MC: 799 (323) GR: 693 (280) GMK: 798 (323) Ser: 696 (282)	NA
Finegayan Cantonment/AAFB Family Housing (Alternative E) with NAVMAG North/South LFTRC (Alternative 3)	111 (45)	851 (344)	1,423 (576)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 978 (396) MC: 986 (399) GR: 668 (270) GMK: 978 (396) Ser: 718 (291)	NA
Finegayan Cantonment/AAFB Family Housing (Alternative E) with NAVMAG L-Shaped LFTRC (Alternative 4)	73 (30)	850 (344)	1,367 (553)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 916 (371) MC: 922 (373) GR: 694 (281) GMK: 916 (371) Ser: 697 (282)	NA
Finegayan Cantonment/AAFB Family Housing (Alternative E) with NWF LFTRC (Alternative 5)	95 (39)	917 (371)	1,446 (585)	MFB, MC, GR, GMK, Ser	PSTG, MS	MFB: 970 (392) MC: 971 (393) GR: 726 (294) GMK: 970 (392) Ser: 855 (346)	MFB, MC, GMK: 12 (5)

Legend: GMK = Guam Micronesian kingfisher, GR = Guam rail, MC = Mariana crow, MCM = Mariana common moorhen, MFB = Mariana fruit bat, MS = moth skink, NA = not applicable, PSTG = Pacific slender-toed gecko, Ser = *Serianthes*.

Notes: [(1)]Direct impact - conversion to developed areas.
[(2)]Only species for which there would be a significant impact.

6.2.4.3 Cultural Resources

The collective effects and impacts due to the implementation of the cantonment/family housing alternatives, LFTRC alternatives, IT/COMM lines, and the 2010 ROD-Related Actions would be equal to the combined effects and impacts of each. Cultural resources investigations for these actions are discussed in Sections 6.1, 6.2.1.10, and Chapters 4 and 5. A summary of the collective impact to cultural resources is provided in Table 6.2.4-2.

The 2011 PA, as discussed in Section 3.10.2, establishes a program alternative for complying with NHPA Section 106 requirements. For a description of the program alternative for NHPA Section 106 compliance refer to Section 6.2.1.10 of this chapter.

Table 6.2.4-2. Summary of Cultural Resources Collective Impacts

Alternative Combination	*Construction Impacts*	*Operation Impacts*
Finegayan Cantonment/Family Housing (Alternative A) with Route 15 LFTRC (Alternative 1)	• Potential direct adverse effects to 26 historic properties. • Undetermined effects to 7 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 1 historic property/potential TCP from changes in use that degrade site integrity. • Potential indirect adverse effects to 1 historic property/potential TCP from recreational use and visual intrusion.
Finegayan Cantonment/Family Housing (Alternative A) with NAVMAG East/West LFTRC (Alternative 2)	• Potential direct adverse effects to 32 historic properties. • Undetermined effects to 7 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 2 historic properties from changes in use that degrade site integrity and 1 historic property/potential TCP from recreational use. • Undetermined effects to 2 unevaluated archaeological sites from changes in use that degrade site integrity and 1 potential TCP from additional reduction in accessibility.
Finegayan Cantonment/Family Housing (Alternative A) with NAVMAG North/South LFTRC (Alternative 3)	• Potential direct adverse effects to 34 historic properties. • Undetermined effects to 7 unevaluated buildings, 2 unevaluated archaeological sites, and 1 potential TCP. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 1 historic property/potential TCP (Haputo) from recreational use. • Potential indirect adverse effects to 25 historic properties from changes in use that degrade site integrity. • Undetermined effects to 5 potential TCPs from additional reduction in accessibility and 2 potential TCPs from changes in use that could degrade site integrity.
Finegayan Cantonment/Family Housing (Alternative A) with NAVMAG L-Shaped LFTRC (Alternative 4)	• Potential direct adverse effects to 34 historic properties. • Undetermined effects to 7 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effect to 1 historic property/potential TCP (Haputo) from recreational use. • Potential indirect adverse effects to 24 historic properties from changes in use that degrade site integrity. • Undetermined effects to 5 unevaluated archaeological sites and 2 potential TCPs from changes in use that degrade site integrity and 4 potential TCPs from additional reduction in accessibility.

Table 6.2.4-2. Summary of Cultural Resources Collective Impacts

Alternative Combination	*Construction Impacts*	*Operation Impacts*
Finegayan Cantonment/Family Housing (Alternative A) with NWF LFTRC (Alternative 5)	• Potential direct adverse effects to 47 historic properties. • Undetermined effects to 7 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse impacts under NEPA to 2 historic properties from restricted access. • Potential indirect adverse effects to 3 historic properties from changes in use that degrade site integrity. • Potential indirect adverse effect to 1 historic property/potential TCP (Haputo) from recreational use.
Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with Route 15 LFTRC (Alternative 1)	• Potential direct adverse effects to 23 historic properties. • Undetermined effects to 7 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 3 historic properties/potential TCPs (Haputo, Latte Stone Park, and Pågat site) from recreational use and visual intrusion to the Pågat site. • Potential indirect adverse effects to 1 historic property/potential TCP from changes in use that degrade site integrity.
Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with NAVMAG East/West LFTRC (Alternative 2)	• Potential direct adverse effects to 29 historic properties. • Undetermined effects to 7 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 2 historic properties/potential TCPs (Haputo and Latte Stone Park) due to recreational use and 2 historic properties from use that degrades site integrity. • Undetermined effects to 2 unevaluated archaeological sites from changes in use that degrade site integrity and 1 potential TCP from restricted access.
Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with NAVMAG North/South LFTRC (Alternative 3)	• Potential direct adverse effects to 31 historic properties. • Undetermined effects to 7 unevaluated buildings, 2 unevaluated archaeological sites, and 1 potential TCP. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 25 historic properties from changes in use that degrade site integrity. • Potential indirect adverse effects to 2 historic properties/potential TCPs (Haputo and Latte Stone Park) from recreational use. • Undetermined adverse effects to 2 potential TCPs for changes in use that degrade site integrity. • Undetermined effects to 5 potential TCPs from additional reduction in accessibility.

Table 6.2.4-2. Summary of Cultural Resources Collective Impacts

Alternative Combination	*Construction Impacts*	*Operation Impacts*
Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with NAVMAG L-Shaped LFTRC (Alternative 4)	• Potential direct adverse effects to 31 historic properties. • Undetermined effects to 7 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 2 historic properties/potential TCPs (Haputo and Latte Stone Park) from recreational use. • Potential indirect adverse effects to 24 historic properties from changes in use that degrade site integrity. • Undetermined effects to 4 potential TCPs from additional reduction in accessibility. • Undetermined effects to 5 unevaluated archaeological sites and 2 potential TCPs from changes in use that degrade site integrity.
Finegayan/South Finegayan Cantonment/Family Housing (Alternative B) with NWF LFTRC (Alternative 5)	• Potential direct adverse effects to 44 historic properties. • Undetermined effects to 7 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse impacts under NEPA to 2 historic properties from restricted access. • Potential indirect adverse effects to 2 historic properties/potential TCPs (Haputo and Latte Stone Park) from recreational use. Potential indirect adverse effects to 3 historic properties from changes in use that degrade site integrity.
AAFB Cantonment/Family Housing (Alternative C) with Route 15 LFTRC (Alternative 1)	• Potential direct adverse effects to 24 historic properties. • Potential impacts to culturally important natural resources from vegetation removal. • Undetermined effects to 12 unevaluated buildings.	• Potential indirect adverse effects to 1 historic property/potential TCP from changes in use that degrade site integrity. • Potential indirect adverse effects to 1 historic property/potential TCP (Pågat site) from recreational use and visual intrusion.
AAFB Cantonment/Family Housing (Alternative C) with NAVMAG East/West LFTRC (Alternative 2)	• Potential direct adverse effects to 30 historic properties. • Potential impacts to culturally important natural resources from vegetation removal. • Undetermined effects to 12 unevaluated buildings.	• Potential indirect adverse effect to 2 historic properties from changes in use that degrade site integrity. • Undetermined effects to 2 unevaluated archaeological sites from changes in use that degrade site integrity. • Undetermined effect to 1 potential TCP from additional reduction in accessibility.
AAFB Cantonment/Family Housing (Alternative C) with NAVMAG North/South LFTRC (Alternative 3)	• Potential direct adverse effects to 32 historic properties. • Potential impacts to culturally important natural resources from vegetation removal. • Undetermined effects to 12 unevaluated buildings, 2 unevaluated archaeological sites, and 1 potential TCP.	• Potential indirect adverse effects to 25 historic properties from changes in use that degrade site integrity. • Undetermined effects to 2 potential TCPs from changes in use that degrade site integrity. • Undetermined effects to 5 potential TCPs from additional reduction in accessibility.

Table 6.2.4-2. Summary of Cultural Resources Collective Impacts

Alternative Combination	*Construction Impacts*	*Operation Impacts*
AAFB Cantonment/Family Housing (Alternative C) with NAVMAG L-Shaped LFTRC (Alternative 4)	• Potential direct adverse effects to 32 historic properties. • Undetermined effects to 12 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 24 historic properties from changes in use that degrade site integrity. • Undetermined effects to 4 potential TCPs from additional reduction in accessibility. • Undetermined effects to 5 unevaluated archaeological sites and 2 potential TCPs from changes in use that degrade site integrity.
AAFB Cantonment/Family Housing (Alternative C) with NWF LFTRC (Alternative 5)	• Potential direct adverse effects to 41 historic properties. • Undetermined effects to 12 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse impacts under NEPA to 2 historic properties from restricted access. • Potential indirect adverse effects to 3 historic properties from changes in use that degrade site integrity.
Barrigada Cantonment/Family Housing (Alternative D) with Route 15 LFTRC (Alternative 1)	• Potential direct adverse effects to 18 historic properties. • Undetermined effects to 13 unevaluated archaeological locations and 8 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 1 historic property/potential TCP from changes in use that degrade site integrity. • Potential indirect adverse effects to 1 historic property/potential TCP (Pågat site) from recreational use and visual intrusion.
Barrigada Cantonment/Family Housing (Alternative D) with NAVMAG East/West LFTRC (Alternative 2)	• Potential direct adverse effects to 24 historic properties. • Undetermined effects to 13 unevaluated archaeological locations and 8 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 2 historic properties from changes in use that degrade site integrity. • Undetermined effects to 2 unevaluated archaeological sites from changes in use that degrade site integrity. • Undetermined effects to 1 potential TCP from additional reduction in accessibility.
Barrigada Cantonment/Family Housing (Alternative D) with NAVMAG North/South LFTRC (Alternative 3)	• Potential direct adverse effects to 26 historic properties. • Undetermined effects to 15 unevaluated archaeological sites and locations, 8 unevaluated buildings, and 1 potential TCP. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 25 historic properties from changes in use that degrade site integrity. • Undetermined effects to 2 potential TCPs from changes in use that degrade site integrity. • Undetermined effects to 5 potential TCPs from additional reduction in accessibility.

Table 6.2.4-2. Summary of Cultural Resources Collective Impacts

Alternative Combination	*Construction Impacts*	*Operation Impacts*
Barrigada Cantonment/Family Housing (Alternative D) with NAVMAG L-Shaped LFTRC (Alternative 4)	• Potential direct adverse effects to 26 historic properties. • Undetermined effects to 13 unevaluated archaeological locations and 8 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 24 historic properties from changes in use that degrade site integrity. • Undetermined effects to 4 potential TCPs from additional reduction in accessibility. • Undetermined effects to 5 unevaluated archaeological sites and two potential TCPs from changes in use that degrade site integrity.
Barrigada Cantonment/Family Housing (Alternative D) with NWF LFTRC (Alternative 5)	• Potential direct adverse effects to 35 historic properties. • Undetermined effects to 13 unevaluated archaeological locations and 8 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse impacts under NEPA to 2 historic properties from restricted access. • Potential indirect adverse effects to 3 historic properties from changes in use that degrade site integrity.
Finegayan Cantonment/ AAFB Family Housing (Alternative E) with Route 15 LFTRC (Alternative 1)	• Potential direct adverse effects to 22 historic properties. • Undetermined effects to 14 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 1 historic property/potential TCP from changes in use that degrade site integrity. • Potential indirect adverse effects to 1 historic property/potential TCP from recreation use and visual intrusion.
Finegayan Cantonment/ AAFB Family Housing (Alternative E) with any NAVMAG LFTRC Alternative (Alternative 2)	• Potential direct adverse effects to 28 historic properties. • Undetermined effects to 14 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 2 historic properties from changes in use that degrade site integrity. • Undetermined effects to 2 unevaluated sites for changes in use that degrade site integrity. • Undetermined effects to 1 potential TCP from restricted access.
Finegayan Cantonment/ AAFB Family Housing (Alternative E) with any NAVMAG LFTRC Alternative (Alternative 3)	• Potential direct adverse effects to 30 historic properties. • Undetermined effects to 14 unevaluated buildings. • Undetermined effects to 2 unevaluated sites and 1 potential TCP. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 25 historic properties from changes in use that degrade site integrity. • Undetermined effects to 2 potential TCPs from changes in use that degrade site integrity. • Undetermined effects to 5 potential TCPs from additional reduction in accessibility.

Table 6.2.4-2. Summary of Cultural Resources Collective Impacts

Alternative Combination	*Construction Impacts*	*Operation Impacts*
Finegayan Cantonment/ AAFB Family Housing (Alternative E) with any NAVMAG LFTRC (Alternative 4)	• Potential direct adverse effects to 30 historic properties. • Undetermined effects to 14 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 24 historic properties from changes in use that degrade site integrity. • Potential indirect adverse effects to 4 potential TCPs from restricted access. • Undetermined effects to 5 unevaluated sites and 2 potential TCPs for changes in use that degrade site integrity.
Finegayan Cantonment/ AAFB Family Housing (Alternative E) with NWF LFTRC (Alternative 5)	• Potential direct adverse effects to 43 historic properties. • Undetermined effects to 14 unevaluated buildings. • Potential impacts to culturally important natural resources from vegetation removal.	• Potential indirect adverse effects to 3 historic properties from changes in use that degrade site integrity. • Potential indirect adverse effects to 2 historic properties from restricted access.

CHAPTER 7
CUMULATIVE EFFECTS

7.1 CUMULATIVE EFFECTS ANALYSIS FOR 2010 FINAL EIS COMPARED TO SEIS

Chapter 7: Cumulative Effects

For each of the 18 environmental resources analyzed in this SEIS:

- ✓ **Identifies the study area** – the study area is Guam-wide for each resource and includes submerged lands
- ✓ **Describes direct and indirect impacts** – from construction and operation of the proposed action that may contribute to a cumulative effect
- ✓ **Lists recently completed, present, and reasonably foreseeable future projects** – the designated timeframe identified in this SEIS is 2009-2028
- ✓ **Analyzes long-term impacts of cumulative projects** – assess the potential for cumulative projects to impact each environmental resource
- ✓ **Evaluates cumulative impacts of the cumulative projects in conjunction with the collective action alternatives** – using strong, moderate, or low impact determinations

There are many frameworks for conducting cumulative effects analysis. USEPA and GEPA have endorsed the use of the approach described in *Defining Cumulative Impact, Approach and Guidance* (California Department of Transportation, USEPA, and FHWA 2005) that identifies eight steps for a cumulative effects analysis. This methodology and general CEQ guidance for assessing cumulative effects is as described in the 2010 Final EIS (Volume 7, Chapter 4: Cumulative Effects, Sections 4.1: Consistency with Cumulative Effects Analysis Guidance and Section 4.2: Cumulative Effects Methodology, pages 4-1 to 4-4).

There are inherent differences between the cumulative effects analysis prepared for the 2010 Final EIS and this SEIS:

- The cumulative effects study area for this SEIS is limited to Guam and specifically excludes the CNMI because there is no proposed action for the CNMI in this SEIS. Further, the four training ranges proposed on Tinian that were included in the 2010 ROD are on hold pending completion of a separate environmental study, the CNMI Joint Military Training EIS/OEIS.
- In accordance with the 2012 Roadmap Adjustments, the magnitude of the Marine Corps proposed action, as described in Section 1.2 of this SEIS, is reduced from that proposed in the 2010 Final EIS. This SEIS is focused on Marine Corps cantonment/family housing and LFTRC alternatives and supporting infrastructure. The relocating population resulting from implementation of the proposed action is substantially less than that proposed in the 2010 Final EIS, and the population growth and construction schedule are much more gradual than originally projected. The adaptive program management that was proposed to monitor the impact of rapid construction and peak population growth of the 2010 Final EIS proposed action is not warranted for this SEIS proposed action.
- The 2010 Final EIS considered the cumulative effect of the preferred alternative only. This SEIS assesses multiple alternatives.
- The alternatives assessed in this cumulative effects chapter are the proposed action alternatives plus the 2010 ROD-Related Actions. These alternatives are referred to as the "collective action alternatives" and were introduced in Section 6.2, Collective Impacts Including 2010 ROD-Related Actions.
- The list of recently completed, present, and reasonably foreseeable projects was updated subsequent to the completion of the 2010 Final EIS.

Both the 2010 Final EIS and this SEIS address cumulative effects under a separate chapter. For this SEIS, Chapters 4 and 5 present impact analyses for components of the collective action alternatives, with the collective action alternatives addressed in Chapter 6. Although cumulative effects could have been addressed in Chapter 6, it was determined that a separate chapter focused specifically on cumulative effects would improve readability of this SEIS.

7.2 METHODOLOGY - EIGHT STEP APPROACH OVERVIEW

The following is a list of the *Defining Cumulative Impact, Approach and Guidance* (California Department of Transportation, USEPA, and FHWA 2005) "eight steps" applied to perform the cumulative effects analysis for this SEIS:

1. Identify resources to consider in the cumulative effect analysis.
2. Define the study area for each resource.
3. Describe the current health and historical context for each resource.
4. Describe direct and indirect impacts of the proposed project that might contribute to a cumulative effect.
5. Identify other reasonably foreseeable future actions that affect each resource.
6. Assess potential cumulative effects.
7. Report the results.
8. Assess the need for mitigation.

Each of these steps is addressed in subsequent sections to guide the reader through the analysis.

7.3 STEPS 1 TO 3: IDENTIFY RESOURCES TO INCLUDE, DEFINE THE STUDY AREA, DESCRIBE CURRENT HEALTH AND HISTORICAL CONTEXT FOR EACH RESOURCE

Steps 1 through 3 of the cumulative effect analysis are as follows:

1. **Identify resources to consider in the cumulative effect analysis.** Chapters 4, 5 and 6 of this SEIS address the direct and indirect impacts of the proposed action components and the collective action alternatives on various resources: geological and soil resources, water resources, air quality, noise, airspace, land and submerged land use, recreation, terrestrial biological resources, marine biological resources, cultural resources, visual resources, ground transportation, marine transportation, utilities, socioeconomics and general services, hazardous materials and waste, public health and safety, and environmental justice and the protection of children. Although the magnitude of the proposed action is reduced in this SEIS relative to the 2010 Final EIS, the proposed action represents the largest action being proposed for Guam in the recent past and foreseeable future; therefore, all of the environmental resources listed are considered in this cumulative effect analysis.
2. **Define the study area.** The study area is Guam-wide for each resource. The cumulative effects study area also includes submerged lands encompassed by the LFTRC SDZ. As mentioned in Section 7.1 of this SEIS, Tinian and other CNMI locations are not included in this SEIS cumulative effects study area.

3. **Describe the current health and historical context for each resource.** The 2010 Final EIS (Volume 7, Chapter 1: Introduction, Section 1.3: Historical Perspective-Guam, pages 1-6 to 1-13) provides an overview of key events in the history of Guam that have influenced the island's environmental resources. These are not repeated in this SEIS. The trends in, and factors affecting, resource health island-wide (i.e., human behavior and natural events) have played a role in the existing conditions (or affected environment) of each resource as described in Chapters 3 through 6 of this SEIS. Existing conditions were updated to incorporate new information identified subsequent to the 2010 Final EIS. A summary of findings is reported under each resource in Section 7.6 under the subsections entitled, *Current Health and Historical Context*. In addition to the long-term historical perspective, recent trends in resource health and resiliency are considered. These recent trends are based on a review of recently completed projects, as listed in Section 7.5. Recently completed projects may include changes in zoning policy or increased regulatory control over construction that would impact the future health trend of a resource and the potential for cumulative effects.

7.4 STEP 4: DESCRIBE DIRECT AND INDIRECT IMPACTS OF THE PROPOSED PROJECT THAT MIGHT CONTRIBUTE TO CUMULATIVE EFFECTS

Typically, cumulative effects analysis is conducted on the action alternatives; however, in this SEIS the direct and indirect impact analysis and the cumulative effects analysis is based on the "*collective action alternatives*" impacts, as described in Chapter 6.2 of this SEIS.

Due to the complexity of the proposed action and the large number of alternatives, this SEIS presents the direct and indirect impacts of the two key components of the proposed action in separate chapters: Chapter 4 (cantonment/family housing alternatives) and Chapter 5 (LFTRC alternatives). The impacts of the pairing of each cantonment/family housing alternative with each of the LFTRC alternatives plus the impacts of IT/COMM infrastructure connecting the two components are presented in Section 6.1 as "additive" impacts. Additive impacts were identified (see Table 6.1.3-1) for the following resources under each pairing of cantonment/family housing and LFTRC alternative: geological and soil resources (LSI), water resources (LSI), noise (LSI), air quality (LSI), terrestrial biology (LSI), cultural resources (SI-M), ground transportation (SI/SI-M), socioeconomics and general services (land acquisition) (LSI), hazardous materials and waste (LSI), and public health and safety (LSI). No "additive" impact was identified for the remaining resource areas.

Section 6.2 of this SEIS acknowledges that there may be additional impacts that result from the proposed action in conjunction with the 2010 ROD-Related Actions (summarized in Table 6.2.1-1). The combined alternatives, as described in Section 6.1 plus the 2010 ROD-Related Actions (Section 6.2), are referred to in this chapter (Chapter 7) as "*collective action alternatives."* More detail on the collective action alternative impacts is provided in Section 6.2. In summary, no impacts were identified for the collective action alternatives for airspace, land and submerged land use, visual resources, or socioeconomics and general services. Significant impacts were identified for terrestrial biology and cultural resources for specific collective action alternatives. Less than significant impacts were identified for the remaining resources.

To facilitate the cumulative effects analysis, the highest level of significance identified under each resource for each collective action alternative is the significance impact level used in the cumulative effects analysis, as shown on Table 7.4-1. This simplification provides a "worst-case" assessment of the potential adverse impacts of each collective action alternative. Construction and operational impacts as

well as direct and indirect impacts were considered in assigning the highest level of significance. If the construction or indirect impact would have a higher level of significant impact on the long-term health or resilience of a resource than the operational or direct impacts, then it is this significance level that is included in the table. It is important to note that there may be short-term high levels of significance reported for the construction phase, but cumulative effects focuses on long-term trends in resource health. For example, short-term impacts to traffic during construction may be significant but would not impact the long-term operation-phase traffic conditions. Similarly, if the 2010 ROD-Related Actions impact was reported at a higher level of significance than the SEIS cantonment/family housing or LFTRC impacts, then the 2010 ROD-Related Action impact is shown in the table. The discussion of these results by resource is presented in Section 7.7, under the heading "*Direct and Indirect Impacts of the Collective Action Alternatives That Might Contribute to a Cumulative Effect*." The less than significant impacts identified have potential to contribute to a significant cumulative effect.

Some of the resources have multiple criteria with varying levels of significance and the criteria are listed in Table 7.4-1. Table 7.4-1 is further simplified in Table 7.6-2. The highest level of significance identified in the multiple criteria under each resource becomes the significance level for that resource and is used in this cumulative effects analysis. The result is that each collective action alternative has one reported level of significance for each resource in Table 7.6-2.

As shown in Table 7.4-1, when the impact analysis data is simplified to the highest level of significance for each resource, all of the collective action alternatives would have a significant level of impact (SI or SI-M) on multiple resources. No single collective action alternative stands out as having the least environmental impact. The 2010 ROD-Related Action impacts are the same for all collective action alternatives.

The naming convention for the collective action alternatives is: cantonment/family housing alternative *letter* - LFTRC alternative *number*. For example, collective action alternative "A-1" represents the Finegayan/South Finegayan (Alternative A) paired with the Route 15 LFTRC (Alternative 1).

Table 7.4-1. Summary of Collective Action Alternative Impacts

Resource	*Collective Action Alternatives: Cantonment/Family Housing + LFTRC + Additive + 2010 ROD-Related Actions Impacts*														
	A-1	***A-2,3,4***	***A-5***	***B-1***	***B-2,3,4***	***B-5***	***C-1***	***C-2,3,4***	***C-5***	***D-1***	***D-2,3,4***	***D-5***	***E-1***	***E-2,3,4***	***E-5***
GEOLOGICAL AND SOIL RESOURCES															
Soils, Sinkholes, Geologic Hazards	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Topography	SI	A-3 or 4=SI A-2=LSI	SI	SI	B-3 or 4=SI B-2=LSI	SI	SI	C-3 or 4=SI C-2=LSI	SI	SI	D-3 or 4=SI D-2=LSI	SI	SI	E-3 or 4=SI E-2=LSI	SI
WATER RESOURCES															
Surface	NI	LSI	NI	NI	LSI	NI	NI	LSI	NI	LSI	LSI	LSI	NI	LSI	LSI
Groundwater	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M
Nearshore	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M
Wetlands	NI	SI-M	NI	NI	SI-M	NI	NI	SI-M	NI	SI-M	SI-M	SI-M	NI	SI-M	NI
AIR QUALITY	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
NOISE	SI-M	LSI	LSI	SI-M	LSI	LSI	SI-M	LSI	LSI	SI-M	LSI	LSI	SI-M	LSI	LSI
AIRSPACE													NI	LSI	LSI
Civilian Air Traffic	SI-M	SI-M	LSI	SI-M	SI-M	LSI	SI-M	SI-M	LSI	SI-M	SI-M	LSI	SI-M	SI-M	SI-M
Military Air Traffic	NI	NI	SI-M	NI	NI	SI-M	NI	NI	SI-M	NI	NI	SI-M	SI-M	SI-M	SI-M
LAND / SUBMERGED LAND USE															
Loss of Valued Use	SI	A-2 or 4=SI-M A-3=LSI	NI	SI	B-2 or 4=SI-M (B-3=LSI)	NI	SI	C-2 or 4=SI-M (C-3=LSI)	NI	SI	D-2 or 4=SI-M (D-3=LSI)	NI	SI	E-2 or 4=SI-M (E-3=LSI)	NI
Public Access	SI	A-2 or 4=SI-M A-3=LSI	SI	SI	B-2 or 4=SI (B-3 =NI)	SI	SI	C-2 or 4=SI (C-3=NI)	SI	SI	D-2 or 4=SI (D-3=NI)	SI	SI	E-2 or 4=SI (E-3=NI)	SI
Compatibility with Planned/Future Use	SI	LSI	LSI	SI	LSI	LSI	SI	LSI	LSI	SI	LSI	LSI	SI	LSI	LSI
RECREATIONAL RESOURCES	SI	LSI	LSI	SI	LSI	LSI	SI	LSI	LSI	SI	SI	SI	SI	LSI	LSI
TERRESTRIAL BIOLOGICAL RESOURCES															
Vegetation	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M
Terrestrial Conservation Areas	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	D-3 or 4=SI-M D-2=LSI	SI-M	SI-M	SI-M	SI-M
Native Wildlife	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Special-Status Species: Federal ESA-Listed and Proposed Species	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M
Special-Status Species: Guam-listed	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	SI-M	SI-M	SI-M	SI-M	SI-M	LSI	LSI	LSI

Legend: LSI = less than significant impact; SI = significant impact; SI-M = significant and mitigable to less than significant.
Impacts that are considered *SI* or *SI-M* are shown in Red font. Blue shading = the Preferred Alternative - Finegayan for Cantonment/AAFB for Family Housing (Alternative E) and NWF (Alternative 5) for LFTRC. Cantonment/family housing Alternatives: A= Finegayan, B= Finegayan and South Finegayan, C = AAFB, D = Barrigada. LFTRC Alternatives: 1 = Route 15; 2, 3, and 4 = NAVMAG Alternatives; 5 = NWF. *Significance level related to additive impacts described in Section 6.1.

Table 7.4-1. Summary of Collective Action Alternative Impacts

Resource	*Collective Action Alternatives: Cantonment/Family Housing + LFTRC + Additive + 2010 ROD-Related Actions Impacts*														
	A-1	***A-2,3,4***	***A-5***	***B-1***	***B-2,3,4***	***B-5***	***C-1***	***C-2,3,4***	***C-5***	***D-1***	***D-2,3,4***	***D-5***	***E-1***	***E-2,3,4***	***E-5***
MARINE BIOLOGICAL RESOURCES															
Marine Flora, Invertebrates, Fish and EFH	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Marine Conservation Areas	LSI	LSI	LSI	LSI	LSI	LSI	NI	NI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
CULTURAL RESOURCES	SI-M	SI-M	SI	SI-M	SI-M	SI	SI-M	SI-M	SI	SI-M	SI-M	SI	SI-M	SI-M	SI
VISUAL RESOURCES	SI-M	A-3 or 4=SI A-2=LSI	LSI	SI-M	B-3 or 4=SI B-2=LSI	LSI	SI-M	C-3 or 4=SI C-2=LSI	LSI	SI-M	D-3 or 4=SI D-2=LSI	LSI	SI-M	E-3 or 4=SI E-2=LSI	LSI
GROUND TRANSPORTATION (off-base traffic, Section 6.1)	*SI-M	*SI-M	*SI-M	*SI-M	*SI-M	*SI-M	*SI	*SI	*SI	*SI	*SI	*SI	*SI	*SI	*SI
MARINE TRANSPORTATION	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
UTILITIES															
Electrical, Solid Waste, IT/COMM	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Potable Water, Wastewater	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M
SOCIOECONOMICS AND GENERAL SERVICES															
Population Change	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI	SI
Public Services	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M
Economic Activity	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Sociocultural Issues	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M
Land Acquisition-Sociocultural, Economic (LFTRC only)	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
HAZARDOUS MATERIALS AND WASTE (Management, Contaminated Sites, Toxic Substances)	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
PUBLIC HEALTH AND SAFETY															
Notifiable Diseases/Mental Illness, UXO, Hazardous Substances, Traffic Incidents	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Operational Safety	LSI	LSI	LSI	LSI	LSI	LSI	SI	SI	SI	LSI	LSI	LSI	LSI	LSI	LSI
ENVIRONMENTAL JUSTICE AND THE PROTECTION OF CHILDREN															
Noise, Recreation	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI	LSI
Socioeconomics, Public Health and Safety	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M	SI-M
Land Acquisition (LFTRC only)	LSI	LSI	NI	LSI	LSI	NI	LSI	LSI	NI	LSI	LSI	NI	LSI	LSI	NI

Legend: LSI = less than significant impact; SI = significant impact; SI-M = significant and mitigable to less than significant.
Impacts that are considered *SI* or *SI-M* are shown in Red font. Blue shading = the Preferred Alternative - Finegayan for Cantonment/AAFB for Family Housing (Alternative E) and NWF (Alternative 5) for LFTRC. Cantonment/family housing Alternatives: A= Finegayan, B= Finegayan and South Finegayan, C = AAFB, D = Barrigada. LFTRC Alternatives: 1 = Route 15; 2, 3, and 4 = NAVMAG Alternatives; 5 = NWF. *Significance level related to additive impacts described in Section 6.1.

7.5 STEP 5: RECENTLY COMPLETED, PRESENT, AND REASONABLY FORESEEABLE FUTURE PROJECTS

Table 7.5-1 is a list of recently completed, present, and reasonably foreseeable future actions that would be completed within a designated timeframe (2009-2028). As mentioned in Section 7.3, part of the assessment of past trends in resource health includes an assessment of recent trends in resource health and identification of recently completed projects assists with that assessment. The timeframe for the cumulative effect assessment is project-specific. This SEIS cumulative effects timeframe begins 6 years prior to possible implementation (2015) of the proposed action and ends with the anticipated completion of construction (2028). The recently completed project timeline is 2009 to 2013 (the year the affected environment analyses for this SEIS were initiated). The present projects would occur while this SEIS is being prepared (2013-2015) and the reasonably foreseeable projects are anticipated to be operational while the proposed action is being constructed and becomes fully operational (2015-2028). Reasonably foreseeable actions are "sufficiently likely to occur, that a person of ordinary prudence would take it into account in making a decision" (Sierra Club v. Marsh, 976 F.2d 763, 767 (1st Cir. 1992). The approach in this SEIS has been more inclusive of projects than exclusive.

The recently completed, present, and reasonably foreseeable future projects list was developed by updating the 2010 Final EIS list of projects with data from Internet searches and interviews with government agencies. The list includes DoD and non-DoD projects. 2010 ROD-Related Actions are not listed as projects for the cumulative impact analysis because they are included as components of the collective action alternatives in Step 4 of the cumulative effects analysis.

The projects in Table 7.5-1 are organized by geographic area. The projects are assigned an identification code, where the letter represents a geographic area and the number is sequential, for example: North (N-1), Central (C-1), Apra (A-1), and South (S-1). Those projects that are Guam-wide or could not be mapped, based on information available, are listed first in Table 7.5-1 with a G-*x* identifier, for example G-1. Figures 7.5-1, 7.5-2, 7.5-3, and 7.5-4 show the approximate project locations in the North, Central, Apra, and South regions of Guam, respectively.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
Guam - General Actions (G) (not mapped)								
G-1	GovGuam	Department of Public Works	Road Safety Improvements	Island-wide	2010	Complete	Phase 1 and 2 pavement markings improvement, guardrail replacement, and school zone sign replacement.	RC
G-2	COMNAV Pacific	NAVFAC Pacific	MIRC EIS/OEIS	Guam/CNMI	2011	Complete	Covers proposed action and alternatives for continued use of the MIRC.	RC
G-3	Air Force	NAVFAC Marianas	MIRC Airspace	Guam/CNMI	No Construction	FONSI	Modify warning area and restricted area airspace within the MIRC.	RF
G-4	GovGuam	GDPW	Traffic Signal System Upgrade, Island-wide	Island-wide	2015	Design	Traffic Signals Installation	RF
G-5	GovGuam	GPA	Upgrade Of Existing 14 Megavolt Ampere Power Transformer To 30 Megavolt Ampere and Underground Line	Marbo to Pågat	2012	Complete	34.5 kV underground line from Marbo Substation to the Pågat Substation. The underground line will extend for 1.6 miles.	RC
G-6	GovGuam	GPA	60 MW Power Plant	Guam	TBD	Unknown	Construct a new 60 MW power plant on Guam.	RF
G-7	Rubio & David	Rubio & David	Health Clinic	Guam - Not Specified	TBD	Permitted	Construction of a health clinic.	P
G-8	Carlos & Rosemarie Takano	Carlos & Rosemarie Takano	Multi-family dwelling	Guam - Not Specified	TBD	Permitted	Construction of two 26-story residential towers.	P
G-9	GovGuam	GPA	Pole Hardening	Island-wide	2013	Programmed	Island-wide power line hardening.	P
G-10	GovGuam	Guam Department of Corrections	Territorial Prison	Guam	TBD	Unfunded	New territorial prison to house 1,000 inmates - site TBD.	RF
G-11	GovGuam	GPA	Lateral Conversion of Power Lines to Underground Lines	Island-wide	2013	Programmed	Lateral conversion of power lines to underground lines.	P

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
G-12	GovGuam	GWA	Wastewater System Planning	Island-wide	2013	Programmed	Infrastructure improvements	P
G-13	GovGuam	GWA	Facilities Plan / Design for WWTP	Guam - Not Specified	2013	Programmed	Infrastructure improvements	P
G-14	GovGuam	GWA	Groundwater Disinfection	Island-wide	2013	Complete	Design of this project is complete. The remaining scope includes the upgrade and construction of new chlorination systems for 99 deep wells and one spring source.	RC
G-15	GovGuam	GWA	Water Booster Pump Station	Island-wide	2013-2016	Construction	The 2005 hydraulic model for GWA's three water systems identified deficiencies in water booster pump capacity. The project will include all improvements necessary to address capacity limitations.	P
G-16	GovGuam	GWA	Implement Groundwater Rule	Island-wide	2013	Complete	This project will provide upgrades to the deep wells for the implementation of the Groundwater Rule. This project will install chlorine residual monitors on all GWA wells. The wells will include supervisory control and data acquisition equipment to communicate the well chlorine levels to central location.	RC
G-17	GovGuam	GWA	Deep Well Rehabilitation	Island-wide	2012	Complete	This project will design and construct up to three new wells to increase supply and include the design and rehabilitation of seven "down-hard" wells.	RC
G-18	GovGuam	GWA	Water Wells	Island-wide	2014	Construction	GWA plans to construct new production wells to produce an estimated 5-7 MGd for natural growth of the island and pending military development.	P

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
G-19	GovGuam	GWA	Wastewater Collection System Replacement/Rehabilitation Program	Island-wide	2012-2016	Construction	Annual recurring design and construction project to replace/rehabilitate ¾ of the total collection system pipes, (8,600 feet/year).	P
G-20	GovGuam	GWA	LS Priority 1 Upgrades	Island-wide	2012-2016	Construction	Specific rehabilitation and repair capital projects are needed for the sewage pump stations (e.g., overhead crane repair and fall protection barriers, high level alarm systems, upgrading electrical controls and motors.	P
G-21	GovGuam	GWA	WWTP Priority 1 Upgrades	Island-wide	2013	Construction	Specific rehabilitation and repair capital projects are needed for the sewage pump stations.	P
G-22	GovGuam	GWA	Water Distribution Pipe Replacement	Island-wide	2012-2016	Construction	Ongoing projects to address water pipe leaks, failure, and age issues	P
G-23	U.S. Pacific Fleet	NAVFAC Pacific	MITT	Mariana Islands & Vicinity	2015	DEIS Published 2013	See Section 7.5.2	P
Guam - North (N)								
N-1	GovGuam	GDPW	Route 29 Reconstruction	Yigo	TBD	Design	Roadway Reconstruction	RF
N-2	Base Corp.	Base Corp.	Paradise Estates	Yigo	2011	Complete	Residential homes Phases II and IV completed with 383 single-family homes near AAFB.	RC
N-3	GovGuam	GDPW	Route 15 Embankment Restoration	Yigo	2012	Complete	Embankment Restoration	RC
N-4	Air Force	NAVFAC Marianas	NWF Perimeter Fence/Road	AAFB	2010	Complete	Infrastructure Improvements	RC
N-5	Air Force	NAVFAC Marianas	PRTC Combat Support Vehicle Facility	AAFB	2010	Complete	Infrastructure Improvements	RC

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
N-6	Air Force	NAVFAC Marianas	PRTC Commando Warrior Operations Facility	AAFB	2010	Complete	Infrastructure Improvements	RC
N-7	Air Force	NAVFAC Marianas	Strike FOL Electrical Infrastructure	AAFB	2010	Complete	Infrastructure Improvements	RC
N-8	GovGuam	GDPW	Skatepark Barrier/Iglesia Circle Traffic Signal	Dededo	2010	Complete	Traffic Safety Improvements	RC
N-9	DON	NAVFAC Marianas	Postal Service Center	AAFB	2010	Complete	Infrastructure improvements	RC
N-10	Pacific International Guam Inc.	Pacific International Guam Inc.	Workforce Housing	Dededo	2010-2011	Complete	Proposed as workforce housing but used as apartments.	RC
N-11	Air Force	AAFB	South Ramp Utilities Phase 2	AAFB	2011	Complete	Infrastructure Improvements	RC
N-12	Air Force	NAVFAC Marianas	PRTC Commando Warrior Barracks	AAFB	2011	Complete	Infrastructure Improvements	RC
N-13	Air Force	NAVFAC Marianas	PRTC Commando Communication Operations Facility	AAFB	2011	Complete	Infrastructure Improvements	RC
N-14	Air Force	NAVFAC Marianas	Strike Operations Group Facility	AAFB	2011	Complete	Infrastructure Improvements	RC
N-15	DON	NAVFAC Marianas	Release a Guam Land Use Plan 77 parcel near South Finegayan	Dededo	2011	Complete	Infrastructure Improvements	RC
N-16	Air Force	36 WG of the Pacific Air Force	Milky Way Site for Multiple Threat Emitter System	AAFB	2012	Complete	Communications facility near NWF	RC

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Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
N-17	GovGuam	GDPW	North Guam Signalization	Yigo	2012	Complete	North Guam Signalization	RC
N-18	Air Force	NAVFAC Marianas	Conventional Munitions Maintenance Facility	AAFB	2012	Complete	Infrastructure Improvements	RC
N-19	Air Force	NAVFAC Marianas	Clear Water Rinse Facility	AAFB	2012	Complete	Infrastructure Improvements	RC
N-20	Air Force	NAVFAC Marianas	PRTC Combat Communication Support Facility	AAFB	2012	Complete	Infrastructure Improvements	RC
N-21	Air Force	NAVFAC Marianas	PRTC Combat Communication Transmission Sys Facility	AAFB	2012	Complete	Infrastructure Improvements	RC
N-22	Air Force	NAVFAC Marianas	PRTC RH Cantonment Operations Facility	AAFB	2012	Complete	Infrastructure Improvements	RC
N-23	Air Force	NAVFAC Marianas	Air Freight Terminal Complex	AAFB	2012	Complete	Infrastructure Improvements	RC
N-24	DON	NAVFAC	Ungulate Fencing	AAFB	2013	Complete	Infrastructure Improvements	RC
N-25	Air Force	36 WG of the Pacific Air Force	Beddown of Training and Support Initiatives at NWF	AAFB	2006-2014	Programmed	Relocate a Rapid Engineer Deployable Heavy Operations Repair Squadron Engineer (RED HORSE) of mobile engineering forces, the Pacific Air Force Commando Warrior training program, the Pacific Air Force SILVER FLAG training program, and a Combat Communication Squadron and its training program at the same location.	P

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
N-26	Air Force	36 WG of the Pacific Air Force	Pacific Airpower Resiliency, AAFB	AAFB	2009-2016	ROD	Base 4 unmanned aerial reconnaissance aircraft, 6 rotational bombers, and up to 12 refueling aircraft at AAFB; and accommodate 48 fighter and 6 bomber aircraft on a rotational basis. An additional 2,400 personnel would be based at AAFB.	P
N-27	DON	NAVFAC Marianas	AT/FP Perimeter Fence and Road Construction and Main Gate at AAFB	AAFB	2010-2013	Complete	Infrastructure Improvements	RC
N-28	Younex Enterprises LLC	Younex Enterprises LLC	Ukudu Workforce Village	Dededo	2010-2011	Complete	New workforce housing to support military build-up on Guam. 18,000 person capacity reduced to 1,800 approved and 500 were constructed under Phase I.	RC
N-29	Sung Kim	Sung Kim	Small Commercial Development	Dededo	2011	Permitted	Small “mom and pop” retail store near the Ironwood Estates.	P
N-30	Air Force	NAVFAC Marianas	South Ramp U&SI II	AAFB	2015	Programmed	Infrastructure Improvements	P
N-31	GovGuam	Guam Housing Authority	Lada Estates - Low Income Affordable Housing	Dededo	2012	Complete	Lada Estates - Low income affordable housing	RC
N-32	GovGuam	GWA	Northern District WWTP Phases 1-3: Primary Capacity 12 MGD	Dededo	2014-16	Prioritized for Funding & Construction	Improvements increase primary capacity to 12 MGD in the first phases and 16 MGD in final phase to meet USEPA discharge requirements. The project will utilize existing structures but add major upgrades and modifications.	P
N-33	Air Force	AAFB	PRTC Combat Command Facility	AAFB	2015	Programmed Unfunded	No Update	P

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Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
N-34	Air Force	NAVFAC Marianas	Dispersed Maintenance Spares & SE Storage Facility	AAFB	2016	Programmed	Infrastructure Improvements	RF
N-35	Golden Gate Services LLC	Golden Gate Services LLC	Single Family Homes	Yigo	2014	Permit extended 2013	72 single-family subdivision	P
N-36	TRI Inc.	TRI Inc.	Paradise Meadows	Yigo	2013	Construction	101 housing units	P
N-37	GovGuam	GDPW	Jinapsan Road	Jinapsan	2013-2014	Construction	1,630-foot (497-m) road would be constructed within an undeveloped GovGuam parcel. The existing paved Tarague Beach Road would be extended to Jinapsan Beach.	P
N-38	Guam Healthcare Development	dck Pacific	Guam Regional Medical City	Dededo	2014	Construction	6-story 267,000-square foot (24,805-square m) 130 bed hospital.	P
N-39	Army	Army	Terminal High Altitude Area Defense (THAAD)	AAFB	2013	Complete	Temporary deployment of 100 unaccompanied military personnel to Guam to operate and support THAAD system; no permanent facility construction.	P
N-40	Air Force	36 WG of the Pacific Air Force	Munitions Storage Igloos AAFB Guam	AAFB	TBD	FONSI	New munitions igloos are required to enable the 36 WG's existing mission and ongoing military operations. Phase 2 would construct 48 munitions igloos to meet the same purpose and need.	P
N-41	Vantage Group	Vantage Group	Villa Pacita Estates	Yigo	TBD	Construction	Private housing division along Route 15 on west side of Mt. Santa Rosa.	P
N-42	GovGuam	Guam Economic Development Authority	Relocation of Dededo Flea Market and Construction of Farmer's Co-op	Dededo	2014	Funded, Bids Sought	New Farmer's Co-op facility to include a retail farmers market, dry and cold storage, feed and material supply, offices for GovGuam agencies, slaughterhouse, value-added kitchen, dining area, flea market stalls, livestock pens, plant nursery, public toilets, and parking.	P

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Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
N-43	Hawaiian Rock Products	Hawaiian Rock Products	Infrastructure Construction	AAFB	2012-2015	Undetermined	Construction, alteration, repair and maintenance of asphalt concrete roads, streets, highways, alleys, parking areas, and their associated facility on the airfield.	P
N-44	DON	NAVFAC Marianas	North Ramp Parking Apron	AAFB	2014	Programmed	Infrastructure Improvements	P
N-45	Air Force	NAVFAC Marianas	Personnel Protection - Hardened Command Post	AAFB	2015	Programmed	Infrastructure Improvements	P
N-46	DON	NAVFAC Marianas	Create Broad Area Maritime Surveillance Capability	AAFB	2014	Programmed	Infrastructure Improvements	P
N-47	DON	NAVFAC Marianas	POL System Hardened Structures	AAFB	2014	Programmed	Infrastructure Improvements	P
N-48	Air Force	NAVFAC Marianas	Tactical Missile Maintenance Facility	AAFB	2014	Programmed	Infrastructure Improvements	P
N-49	Air Force	NAVFAC Marianas	PRTC RH Airfield Operations	AAFB	2014	Programmed	Administrative/Storage Facility	P
N-50	Air Force	NAVFAC Marianas	PRTC SF Fire Rescue Emergency Management	AAFB	2014	Programmed	Infrastructure Improvements	P
N-51	Air Force	NAVFAC Marianas	Fuel System Maintenance. Hangar, Inc.2	AAFB	2015	Programmed	Infrastructure Improvements	P
N-52	Air Force	AAFB	General Purpose Hangar	AAFB	2015	Programmed	Infrastructure Improvements	RF
N-53	Air Force	NAVFAC Marianas	AGE Covered Facility	AAFB	2014	Programmed	Infrastructure Improvements	P

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Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
N-54	Air Force	NAVFAC Marianas	PRTC RH Logistics Facility	AAFB	2014	Programmed	Infrastructure Improvements	P
N-55	Air Force	NAVFAC Marianas	PRTC Combat Communication Infrastructure Facility	AAFB	2014	Programmed	Infrastructure Improvements	P
Guam - Central (C)								
C-1	GovGuam	GDPW	Route 15 Resurfacing	Barrigada	2009	Complete	Pavement Resurfacing	RC
C-2	Access Development Company	Access Development Company	Talo Verde Estates	Tumon	2009	Complete	Luxury housing community; Single family dwellings (62) and Townhouses (82).	RC
C-3	Office of Veterans Affairs	Office of Veterans Affairs	Veterans Clinic	Agaña	2009	Complete	The Veterans Clinic would be located just outside of the Naval Hospital along Route 7.	RC
C-4	Tanota Partners (Ysrael family)	Tanota Partners (Ysrael family)	Hotel Construction Bayview 5 Luxury Project, Tumon Bay	Tumon	2010	Complete	Construction of 400-room, 28-story hotel in Tumon Bay.	RC
C-5	GovGuam	GDPW	Route 1 U-Turn Reconstruction	Tumon	2009	Complete	Roadway Improvement	RC
C-6	GovGuam	GDPW	Route 25 (Alageta Road)	Barrigada	2012	Complete	Route 25 (Alageta Road)	RC
C-7	DLA	NAVFAC Marianas	Replace Gas Cylinder Storage Facility	Andersen South	2010	Complete	Infrastructure Improvements	RC
C-8	DON	NAVFAC Marianas	Naval Hospital Replacement	Asan	2010	Complete	Infrastructure Improvements	RC
C-9	GUANG	NAVFAC Marianas	NG Readiness Center	Barrigada	2010	Complete	Infrastructure Improvements	RC
C-10	GUANG	NAVFAC Marianas	DRBS Storage Facility	Barrigada	2011	Complete	Infrastructure Improvements	RC

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Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
C-11	GUANG	NAVFAC Marianas	Combined Support Maintenance Facility	Barrigada	2011	Complete	Infrastructure Improvements	RC
C-12	Tagada Guam LLC	Tagada Guam LLC	Amusement Park-Tumon	Tumon -	2011	Complete	Amusement park with rides, food, and beverage booths.	RC
C-13	GovGuam	GCC	Student Center	Mangilao	2011	Complete	Student Center at GCC	RC
C-14	GovGuam	GDPW	Route 6 (Murray Rd)	Asan	2012	Complete	Route 6A Murray Rd, 9 Maina-Nimitz Hill, embankment restoration	RC
C-15	GovGuam	GDPW	Route 16 Guam Main Facility Post Office / Army National Guard Intersection	Barrigada	2012	Complete	Route 16 Guam Main Facility Post Office / Army National Guard Intersection	RC
C-16	GovGuam	GDPW	Route 8/10/16 Tri-Intersection	Barrigada	2012	Complete	Route 8/10/16 Tri-Intersection	RC
C-17	GovGuam	GCC	DNA Forensic Lab	Mangilao	2012	Complete	DNA Forensic Lab	RC
C-18	GovGuam	GCC	Foundation Building	Mangilao	2012	Complete	Foundation Building at GCC	RC
C-19	GovGuam	PAG	Gregorio D. Perez Dock A & B Steel Pile Extension & H20 Blasting	Agaña	2012	Complete	Gregorio D. Perez Dock A & B Steel Pile Extension & H20 Blasting	RC
C-20	GovGuam	GPA	Fiber Optic Installation	Tumon	2012	Complete	Installation of a 96-count strand of cable via an underground conduit along San Vitores Road stretching the length of Hotel Row.	RC
C-21	Private Development	Younex International Corp.	Emerald Ocean View Park	Tumon	TBD	Stalled Construction	260 luxury condo unit, 20 villas, two 18-story towers and two 15-story towers. Stalled due to financial difficulties.	P
C-22	GovGuam	Guam Memorial Hospital Authority	Guam Memorial Hospital Emergency Room Expansion	Tamuning	2014	Construction	Triples emergency room capacity.	P

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ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
C-23	Ordot Dump Closure	GSWA	Ordot Dump Closure Construction and Dero Road Sewer Improvements	Ordot	2014-2015	Contract Awarded	The project includes construction of all temporary and permanent facilities, erosion controls, excavation, grading, drainage, fill, cap system including geosynthetics, leachate and sewage collection/conveyance systems, backup emergency power generator, electrical, and fencing.	P
C-24	GovGuam	GEDA	Guam Museum	Hagåtña	2014	Construction	Facility will include exhibition space, garden, outdoor stage, café/retail space, and administrative offices.	P
C-25	Laguna at Pago Bay Resort	Fong S. Wu	Upscale Residential Development	Pago Bay	2011	21 of 98 lots sold	48-acre (parcel containing 98 lots. Roads, three lakes, landscaping and utility connections including underground natural gas lines have been constructed.	RC
C-26	Micronesian Self Help Housing Corp	GHURA	Sagan Bonita	Mangilao	2013	Complete	56 single affordable family homes	RC
C-27	Orion Construction	Mark Borja	Island Surgical Center	Dededo	2013	Complete -	3,500-square foot surgical center.	P
C-28	GovGuam	GHURA	Summer Green Residences (formerly Tower 70) Multi-Family Units	Tamuning	2014	Complete in 2014	72 multi-family affordable housing units	P
C-29	GovGuam	GDPW	Route 1-8 Intersection Improvements & Agaña Bridges Replacement	Agaña	2014	Construction	Intersection Improvements & Bridges Replacement	P
C-30	GovGuam	GWA	Rehabilitation of Asan Springs	Asan	2012	Prioritized for Funding & Construction	Rehabilitate/upgrade reservoir, treatment/chlorination facility, pump/motors and electrical controls.	RC

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Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
C-31	GovGuam	GDPW	Route 26/25 Intersection Improvements	Guam - Central	2014	Final Design IFB Sept 2013	Intersection Improvements & Traffic Signal Activation	RF
C-32	UoG	UoG	Wind Turbine	University Drive	2013	Complete	A 70-foot (21.3 m) wind turbine	RC
C-33	UoG	UoG	Field House Renovation	University Drive	2012	Construction	Field House Renovation	RC
C-34	Access Development Company	Access Development Company	Hemlani Apartments	Tumon	2013	Complete	300-unit apartment complex (behind Acanta Mall, Tumon Bay).	P
C-35	GovGuam	Guam International Airport Authority	Guam Airport Project	Guam International Airport	2009-2029	Ongoing	Various upgrades to airport property, main terminal, industrial park, airfield, and south ramp.	RF
C-36	GovGuam	GDPW	Route 26 Reconstruction & Widening, Route 1 to Route 25	Dededo	TBD	Design Complete	Reconstruction & Widening	RF
C-37	GovGuam	GDPW	Route 10A, Rehabilitation & Widening, Sunset Blvd. to Route 16	Harmon	TBD	Design Complete	Pavement Rehabilitation & Widening	RF
C-38	GovGuam	Guam International Airport Authority	Runway Rehabilitation and Expansion	Tamuning	2014	Ongoing	Runway rehabilitation and expansion from grant via U.S. Federal Government. Multiple phases.	P
C-39	GovGuam	PAG	Gregorio D. Perez Marina Renovation & Site Improvement Project	Hagåtña	2012-2014	Prioritized for Funding & Construction	Gregorio D. Perez Marina Renovation & Site Improvement Project	P
C-40	GovGuam	PAG	Gregorio D. Perez Marina Dock C Repairs	Hagåtña	2013	Complete	Gregorio D. Perez Marina Dock C Repairs	P

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
C-41	GovGuam	GWA	Facilities Plan for Hagåtña STP Improvements & Effluent WWPS	Hagåtña	2012-2014	Complete	At least one additional primary clarifier of similar size is required to meet current and future wastewater capacity and redundancy requirements. A new effluent pump station is required for the disposal of future flows at high tide conditions.	P
C-42	GovGuam	GWA	Hagåtña STP Improvements and Effluent Wastewater Pump Station	Hagåtña	2012-2014	Complete	Provide a new primary clarifier to meet current and future wastewater capacity and redundancy requirements. The new equipment includes screenings, grit removal and effluent WWPS sized for current and future (Year 2015 projected flow).	P
C-43	GovGuam	GWA	Agaña STP Interim Measures	Agaña	2013-2014	Construction	Process upgrades to include grit removal; fat, oil and grease removal; septic handling facility; prevent back flow from the new outfall; bio-solids treatment; and any additional improvements, rehabilitation or improvements, such as the use of chemically enhanced treatment.	P
C-44	Defense Logistics Agency-Energy	NAVFAC Marianas	Upgrade Fuel Pipeline	Central Guam	2013-2015	Planning and Programming Phase	Infrastructure improvements to fuel pumps and pipelines that extend from the Sasa Valley Fuel Farm to AAFB. Project includes a new 15.7-mile (25.3 km) pipeline that is parallel and adjacent to existing pipeline and located within an existing 10-foot (3-m) wide easement.	P

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
C-45	GUANG	NAVFAC Marianas	Assembly Hall	Barrigada	2013	Programmed	Infrastructure Improvements	P
C-46	GovGuam	GDPW	Route 8/Canada Toto Loop Road Intersection Improvements	Tamuning	2015	Design	Traffic Signal Installation	P
C-47	Guam Highlands Investment Group	Guam Highlands Investment Group	Sigua Highlands / near Leopalace	Yona	2014-2034	Zoning Permit Pending	5,000 home subdivision	RF
C-48	GovGuam	GDPW	Tiyan Parkway, Phase 1	Tiyan	2015	Design	New Arterial Highway	P
C-49	GovGuam	GDPW	Route 14B (Ypao Road) Reconstruction & Widening, Route 1 to Route 14	Tamuning	2015	Design	Reconstruction & Widening	P
C-50	GovGuam	GDPW	Route 10A, Route 1 GIA/Tiyan Intersection	Tiyan	2016	Design	Reconstruction & Widening	RF
C-51	GovGuam	GDPW	Route 7A Rehabilitation	Tamuning	2012	Complete	Reconstruction & Drainage Improvements	RC
C-52	GovGuam	GDPW	Route 4, McDonalds to Route 10	Chalan Pago	2013	Complete	Pavement Resurfacing	RC
C-53	GovGuam	GDPW	Finegayan Road Reconstruction-Harmon Cutoff	Dededo	TBD	Design	Finegayan Road Reconstruction	RF
Guam - Central Apra Harbor (AH)								
AH-1	DON	NAVFAC Marianas	Orote Magazines (P-425)	Navy Base	2014	Programmed	Infrastructure Improvements	P
AH-2	GovGuam	GovGuam and the DON	Reforestation of Masso Reservoir	Masso Reservoir	TBD	Ongoing	The reforestation plan was developed as a mitigation project for coral reef loss in Apra Harbor	P

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
AH-3	GovGuam	GDPW	Masso River Bridge Embankment	Masso River	2011	Complete	Masso River Bridge Embankment Stabilization	RC
AH-4	DON	NAVFAC Marianas	Kilo Wharf Extension (P-502)	Navy Base	2009-2013	Complete	Infrastructure Improvements	RC
AH-5	DON	NAVFAC Marianas	CSS-15 HQ Facility	Navy Base	2010	Complete	Infrastructure Improvements	RC
AH-6	DON	NAVFAC Marianas	Replace Family Housing Units	Navy Base	2010	Complete	Infrastructure Improvements	RC
AH-7	DON	NAVFAC Marianas	NEX Minimart and Gas Station	Navy Base	2010	Complete	Infrastructure Improvements	RC
AH-8	GovGuam	GDPW	Route 11 Improvements and Shore protection	Commercial Port	2013	Complete	Roadway Improvements	P
AH-9	GovGuam	GDPW	Asan and Aguada Bridges Rehabilitation	Asan	TBD	Design	Two bridges' Rehabilitation	RF
AH-10	CNM	DON	X-Ray Wharf Improvements (P-518)	Navy Base	2015	Unfunded	Waterfront improvements to accommodate the new T-AKE supply ship and utility upgrades to meet wharf requirements. Includes construction and dredging at the southern portion of Inner Apra Harbor to -35 feet.	RF
AH-11	GovGuam	PAG	Modernization Program: Port Reconfiguration, Maintenance and Repair	Commercial Port	2010-2016	Construction Ongoing	Three phases. Productivity and efficiency improvements such as new equipment, systems, and buildings, and terminal modernization and new yard capacity. Includes demolition of buildings, new utilities, paving, lighting, cargo handling equipment, stormwater outfalls into Apra Harbor, and security systems.	P

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
AH-12	GovGuam	PAG	Comprehensive Port-wide Closed Circuit Television System	Commercial Port	2013-2014	Ongoing	Comprehensive Port-wide Closed Caption Television Systems	P
AH-13	GovGuam	PAG	Marine & Port Security Operations Center	Commercial Port	2013-2014	Ongoing	Construction of Marine & Port Security Operations Center	P
AH-14	GovGuam	PAG	Emergency Backup Generators	Commercial Port	2014-2015	Ongoing	Installation of Emergency Backup Generators	P
AH-15	GovGuam	PAG	Load Center 4 Building Roof Repair	Commercial Port	2012	Prioritized for Funding & Construction	Load Center 4 Building Roof Repair	RC
AH-16	GovGuam	PAG	Construction of Golf Pier Pipeline Replacement	Commercial Port	2012	Prioritized for Funding & Construction	Construction of Golf Pier Pipeline Replacement	RC
AH-17	GovGuam	GPA	Redesign of Existing Outdoor Substation	Commercial Port	2012	Prioritized for Funding & Construction	Redesign of existing outdoor substation to indoor type. Includes transformer connections to existing diesel plant.	RC
AH-18	GovGuam	GPA	Substation Transformer Upgrade with Concrete Fence	Commercial Port	2012	Prioritized for Funding & Construction	Substation transformer upgrade w/ concrete fence	RC
AH-19	DON	NAVFAC Marianas	Whole House Revitalization I	Navy Base	2015	Contract awarded	Infrastructure Improvements	P
AH-20	DON	NAVFAC Marianas	Whole House Revitalization II	Navy Base	2015	Contractors Bidding	Infrastructure Improvements	P
AH-21	DON	NAVFAC Marianas	Romeo Wharf Improvements	Navy Base	2014	Programmed	Infrastructure Improvements	P
AH-22	DON	NAVFAC Marianas	Emergent Repair Facility Expansion (P-566)	Navy Base	2014	Programmed Unfunded	Infrastructure Improvements	P

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
AH-23	DON	NAVFAC Marianas	Dehumidified Supply Storage Facility	Navy Base	2014	Programmed Unfunded	Infrastructure Improvements	P
Guam - South (S)								
S-1	GovGuam	GDPW	Route 2 - Culverts and Slide Repair	Umatac	2012	Complete	Route 2 - Culverts and Slide Repair	RC
S-2	GovGuam	GDPW	Talofofo / Togcha Bridge Rehabilitation	Talofofo	2012	Complete	Talofofo / Togcha Bridge Rehabilitation	RC
S-3	GovGuam	GDPW	Layon Landfill, Dandan	Dandan	2011	Complete	Development of a municipal integrated solid waste landfill facility and transfer stations that involves construction and operation for diversion, recycling, composting, and processing.	P
S-4	GovGuam	GPA	15 MW Solar / Wind turbine	Talofofo	2013	Contract approved	15 MW solar / wind turbine farm to help power 2,200 homes	P
S-5	GovGuam	GWA	Santa Rita Springs Booster Pump Rehabilitation, Phase II	Santa Rita	2014	Construction	Construction is nearing completion. The project now requires completion of incidental work related to the spring impound and facility function controls. It is the intent of this Capital Improvement Plan project to be "transitioned" into a project where work is required to address the GEPA-pending action related to "GWUDI."	P
S-6	GovGuam	GWA	Ugum Water Treatment Plant Refurbishment	Ugum	2012	Construction	Refurbish Ugum Treatment Plant to convert the existing conventional surface water plant to a micro-filtration system; replace electrical control systems and finished water pumps; install supervisory control and data acquisition equipment; and refurbish the backwash waste handling system.	RC

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
S-7	GovGuam	GWA	Brigade II (Ugum) BPS Upgrade	Ugum	2013	Construction	A new Brigade II booster pump station is required to fully utilize the surface supply from the south or the Ugum Treatment Plant. It will serve both the Windward Hills and the Pulantat Reservoirs. About 1,100 feet (335 m) of pipe is required.	P
S-8	GovGuam	GWA	Ugum Water Treatment Plant Intake Modifications	Ugum	2013	Construction	This project will improve the intake structure of the Ugum Water Treatment Plant to minimize siltation and provide more reliable raw water supply during low river flow conditions.	P
S-9	GovGuam	GWA	Ugum Water Treatment Plant Reservoir Replacement	Ugum	2013	Construction	This project will provide a new 2-MG finished water reservoir at the Ugum Water Treatment Plant. The reservoirs will be the sole source of finished water for most of the Southern Water System.	P
S-10	GovGuam	GWA	Old Agat Wastewater Collection (Phase II)	Agat	2012-2016	Construction	This project will replace a portion of 6.2 miles (10 km) of existing wastewater collection line including manholes and sewer service laterals in the Agat collection system. The replacement sewer lines will be connected to the mainline along Route 2A at Tomas Mesa Street.	P
S-11	GovGuam	GWA	Umatac-Merizo STP Improvements	Merizo	2012	Complete	Installation of high efficiency motors, efficiency aerator, new valves, and dredging of the lagoon.	RC

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
S-12	GovGuam	GWA	Old Agat Collection Continuation (Phase III)	Agat	2012-2016	Construction	This project will replace a portion of 6.2 miles (10 km) of existing wastewater collection line including manholes and sewer service laterals in the Agat collection system. The replacement sewer lines will be connected to the mainline along Route 2A at Tomas Mesa Street.	P
S-13	GovGuam	GWA	Facilities Plan / Design / Interim for Baza Gardens STP Improvements	Talofofo	2013	Complete	This project includes interim improvements at the wastewater treatment facility to meet permit conditions.	RC
S-14	GovGuam	GWA	Baza Gardens STP Replacement	Talofofo	2012-2015	Construction	Construction of new wastewater treatment facilities that will meet NPDES permit treatment limits.	P
S-15	GovGuam	GWA	Agat / Santa Rita STP Replacement	Agat	2012-2016	Construction	Construction of new wastewater treatment facilities that will meet NPDES permit treatment limits. The new facilities will incorporate provisions for redundancy to improve reliability and facilitate operations and maintenance activities at the existing facility.	P
S-16	GovGuam	PAG	Agat Marina Dock A Repair & Renovation	Agat	2013-2014	Prioritized for Funding & Construction	Agat Marina Dock A Repair & Renovation	P
S-17	GovGuam	GWA	Facilities Plan / Design / Interim for the Umatac-Merizo STP	Umatac	2012-2013	Prioritized for Funding & Construction	Phase 1 of this project is a facility planning to meet permit conditions; phase 2 is the design of the interim improvements. Planning and design for interim improvements such as new mechanically cleaned bar screen facilities to improve reliability and facilitate operations and maintenance requirements.	RC

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
S-18	GovGuam	GWA	Umatac-Merizo STP Replacement	Umatac	2016	Design	Construction of new wastewater treatment facilities that will meet NPDES permit treatment requirements. The new facilities will incorporate provisions for redundancy to improve reliability and facilitate operations and maintenance activities at the existing facility.	RF
S-19	GovGuam	GDPW	Agfayan Bridge Replacement	Agfayan Bridge	2015	Construction	Bridge Replacement	P
S-20	GovGuam	GDPW	Route 4, Togcha River to Ipan Beach Park	Yona-Talofofo	2014	Contract Pending	Pavement Resurfacing	P
S-21	GovGuam	GDPW	Route 17, Route 5 to Chalan Tun Ramon Baza, Phase 2A	Santa Rita	2015	Contract Pending	Replace Drainage Culverts & Pavement Spot Repairs	P
S-22	GovGuam	GDPW	Inarajan North Leg (As-Misa) Bridge Rehabilitation	Inarajan	2014	Construction	Bridge Scour Repair	P
S-23	GovGuam	GDPW	Bile & Pigua Bridges Replacement	Merizo	2014	Construction	Bridges Replacement	P
S-24	GovGuam	GDPW	Ajayan Bridge Replacement	Merizo	2015	Design	Bridge Replacement	P
S-25	GovGuam	GDPW	Route 4, Merizo Bridge Approach Restoration	Merizo	2014	Construction	Repair Bridge Approach & Roadway Embankment	P
S-26	GovGuam	GDPW	Aplacho Bridge Replacement	Santa Rita	2014-2016	Design	Bridge Replacement	P
S-27	GovGuam	GDPW	Route 17 Rehabilitation & Widening, Route 5 to Route 4A, Phase 2B	Yona	TBD	Design	Pavement Rehabilitation & Widening	RF

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

Table 7.5-1. Description of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Guam (2009-2028)

ID #	*Lead Agency or Proponent*	*Contracting Authority*	*Project Name / Location*	*Area of Interest*	*Construction Year(s)*	*Status*	*Description*	*Time frame*
S-28	GovGuam	GDPW	Route 4 Curve Widening, Ylig Bridge to Dandan Road	Talofofo	TBD	Pending Approval	Pavement Widening	RF
S-29	GovGuam	GDPW	Route 5 Rehabilitation & Widening, Route 2A to Route 12	Santa Rita	TBD	Design	Pavement Rehabilitation & Widening	RF
S-30	GovGuam	GDPW	Route 17 Rehabilitation and Widening, Route 4 to Chalan Tun Ramon Baza	Yona	2013	Complete	Route 17 Rehabilitation and Widening	RC
S-31	GovGuam	GDPW	Route 4, Ylig Bridge to Pago Bay and Ylig Bridge Replacement	Yona	2013	Construction	Pavement Resurfacing	P
S-32	GovGuam	GDPW	Route 17 Drainage Culverts and Rehabilitation	Santa Rita	TBD	Design	Culvert repair and roadway resurfacing (2 projects)	RF
S-33	GovGuam	GDPW	Taleyfak Bridge Restoration	Agat	2013	Complete	Restore Bridge	RC
S-34	GovGuam	GDPW	Tanaga Bridge Permanent Restoration	Inarajan	2009	Complete	Restore Bridge	RC
S-35	DON	NAVFAC Marianas	Cetti Bay Reforestation	Agat	TBD	Ongoing	Reforestation project as mitigation for Kilo Wharf extension project.	P

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; PRTC= Pacific Range Training Complex; TBD = to be determined.

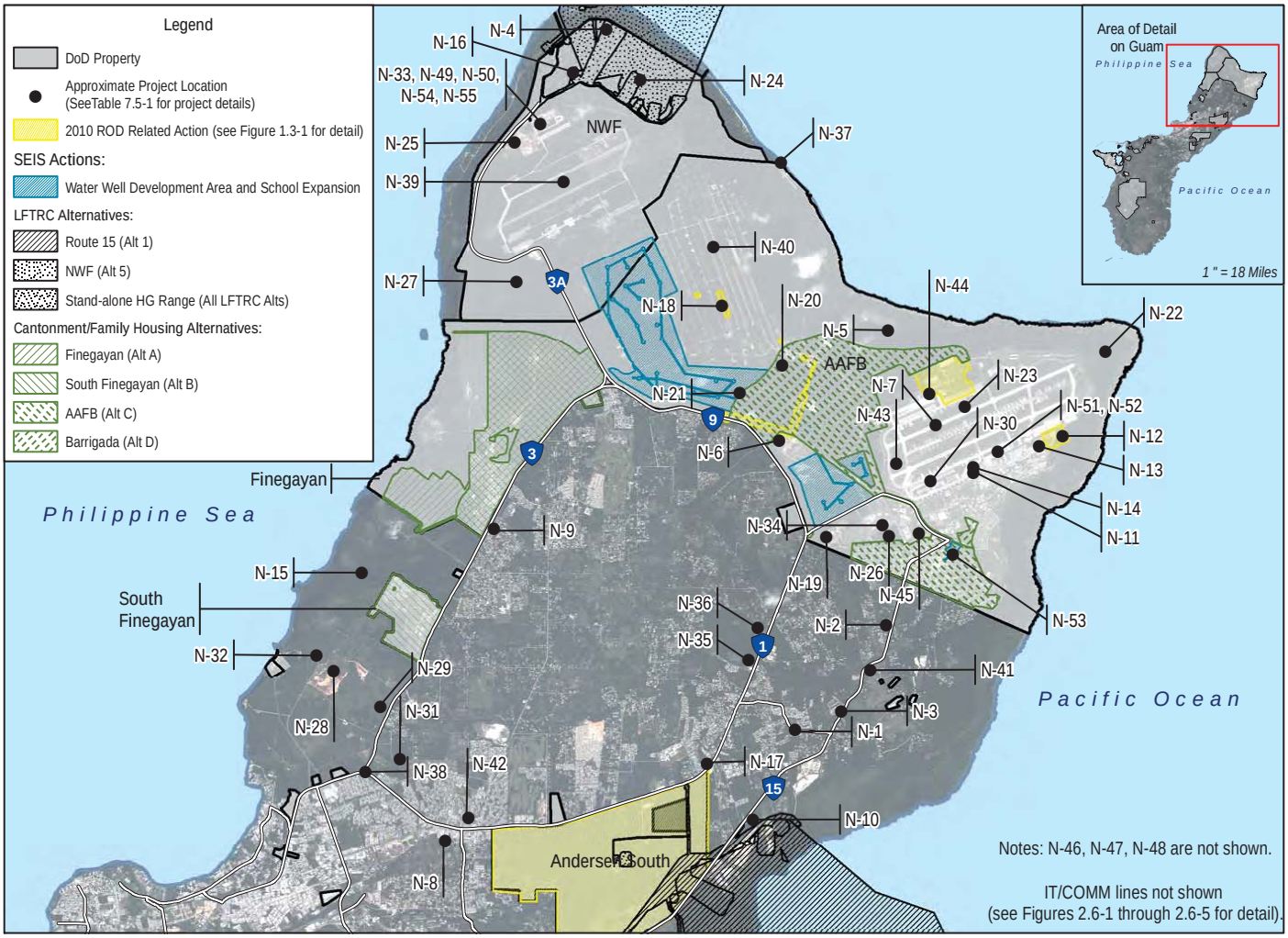


Figure 7.5-1
Recently Completed, Present and Reasonably Foreseeable Projects on Guam (North)

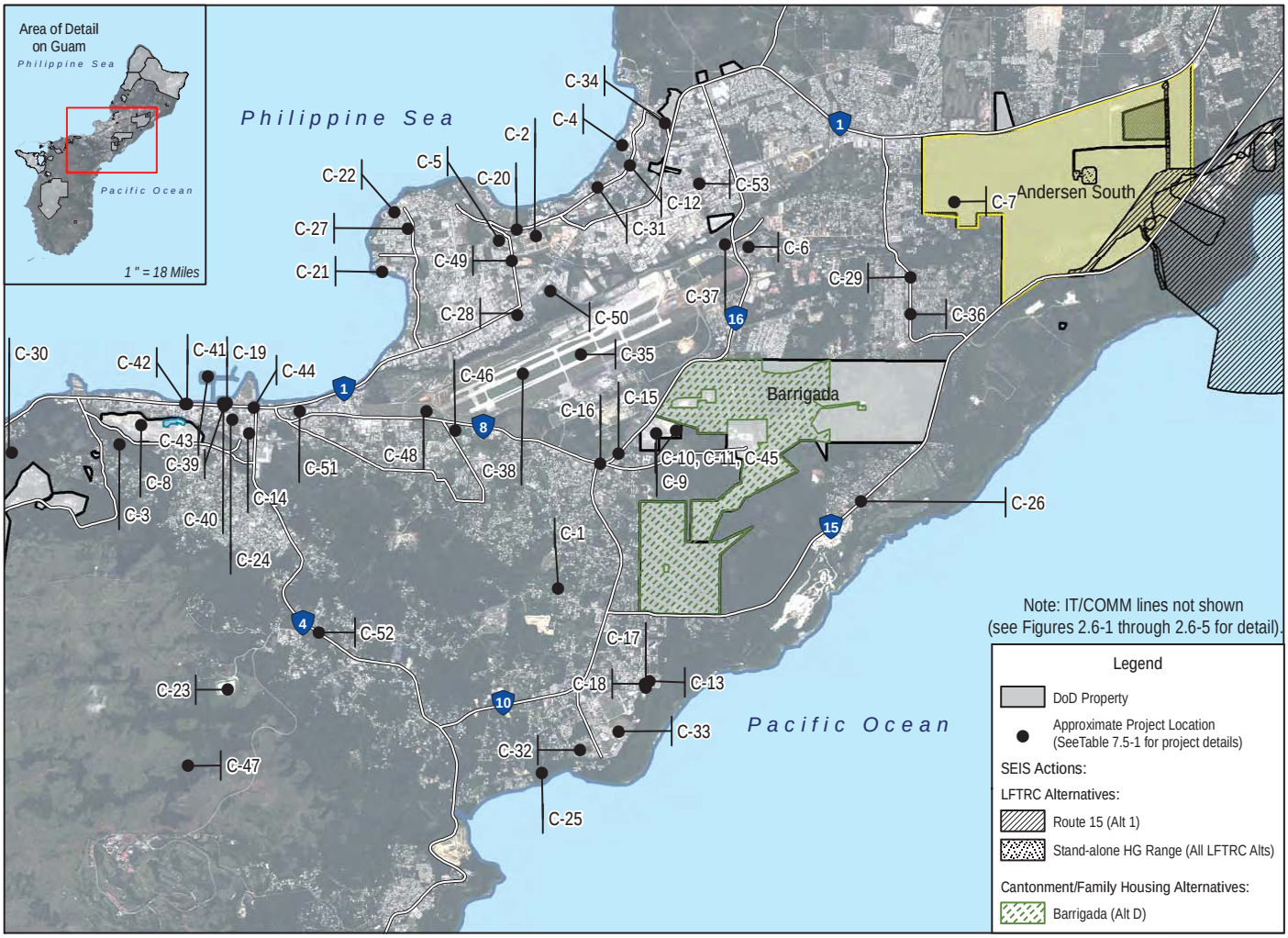


Figure 7.5-2
Recently Completed, Present and Reasonably Foreseeable Projects on Guam (Central)

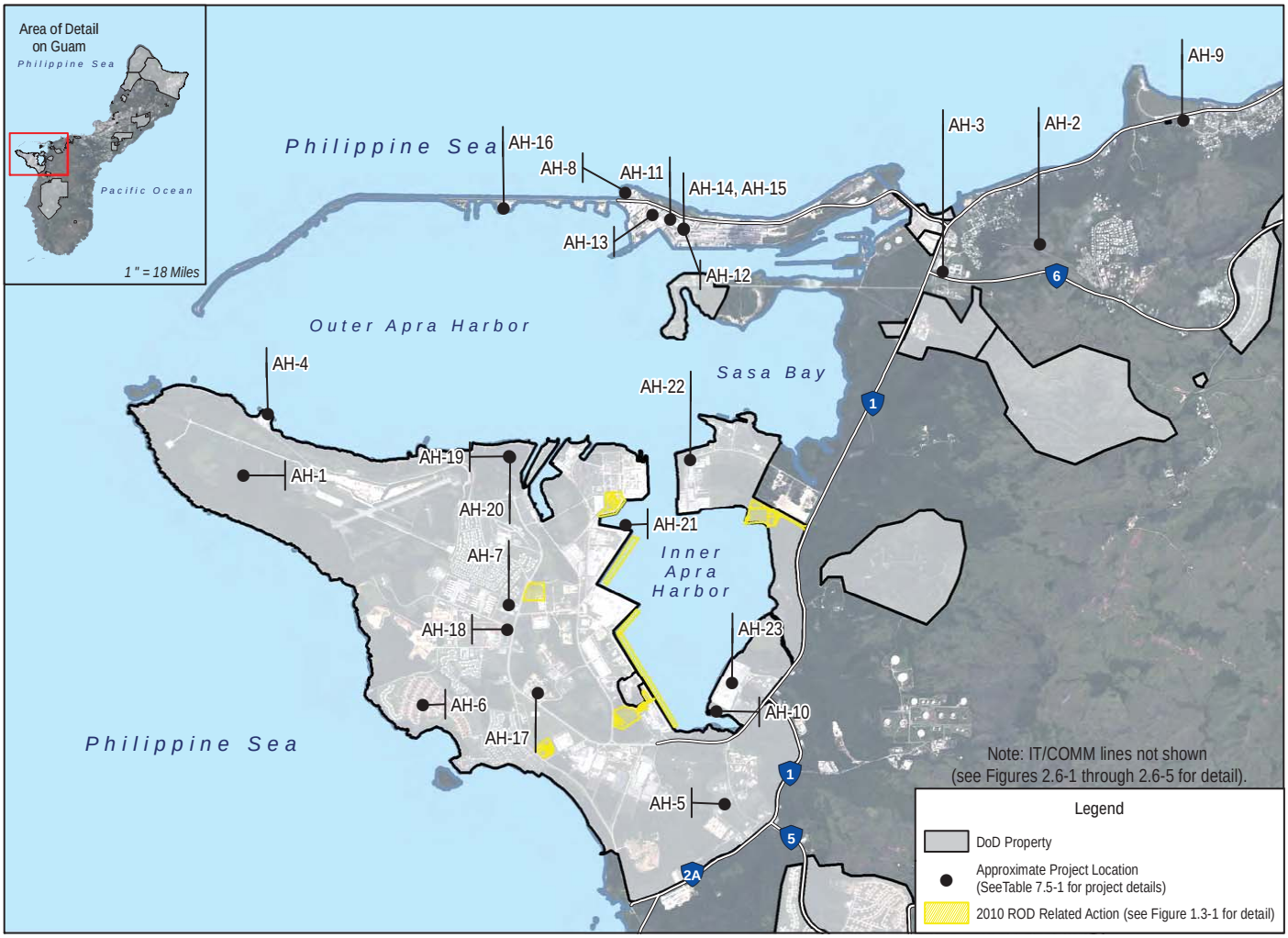


Figure 7.5-3
Recently Completed, Present and Reasonably Foreseeable Projects on Guam (Apra)

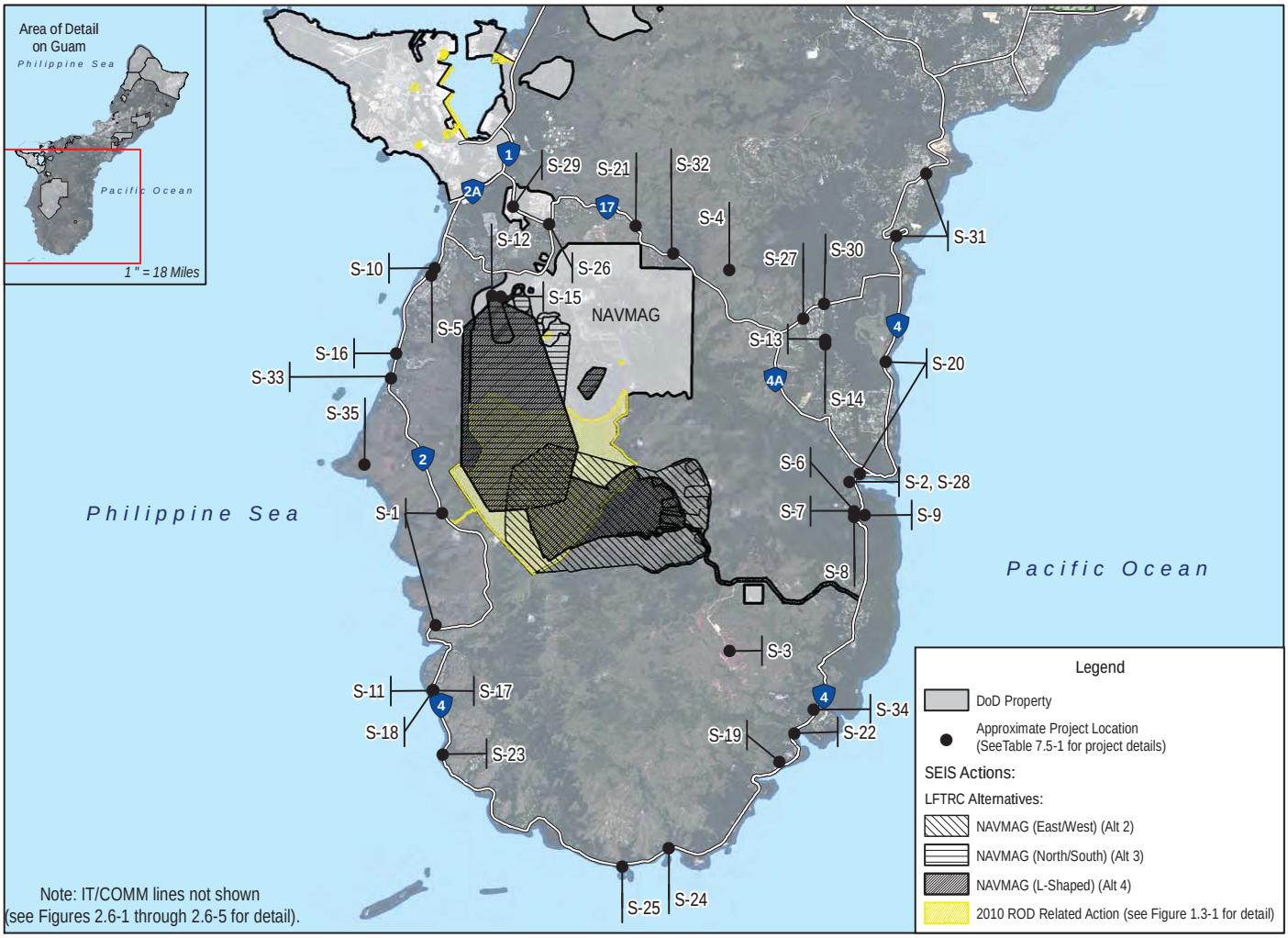


Figure 7.5-4
Recently Completed, Present and Reasonably Foreseeable Projects on Guam (South)

As shown on Figure 7.5-1, the majority of the projects in the northern area of Guam are on AAFB and very few in the civilian community. The proposed action includes cantonment/family housing alternatives on Finegayan and AAFB, LFTRC alternatives at NWF and east of Andersen South, and school and water well field expansions on AAFB. IT/COMM alternatives associated with the proposed cantonment/family housing and LFTRC alternatives are aligned along existing roadways. The 2010 ROD-Related Actions are the non-live fire training at Andersen South and the Air Combat Element of the Marine Corps at AAFB. No reasonably foreseeable civilian projects would be precluded by any of the collective action alternatives in the northern part of Guam.

The collective action alternatives in central Guam include the following (see Figure 7.5-2): a cantonment/family housing alternative at Barrigada, an LFTRC alternative east of Andersen South and non-live fire training at Andersen South as a 2010 ROD-Related Action. A HG Range is also proposed at Andersen South. There are IT/COMM alternatives associated with the LFTRC and cantonment/family housing alternatives in the area. Non-DoD projects unrelated to the collective action alternatives include roadway improvement projects that are distributed throughout the area, and projects near the airport and in Tumon. No reasonably foreseeable civilian projects would be precluded by any of the collective action alternatives in the central part of Guam; however, there a few current land uses that would be discontinued.

The Apra Harbor area (see Figure 7.5-3) includes the waterfront improvement projects of the 2010 ROD-Related Actions. There are no cantonment/family housing or LFTRC alternatives in the Apra Harbor area; however, there are IT/COMM alignment alternatives that would be aligned along existing roadways (not shown on Figure 7.5-3) in the vicinity of Apra Harbor. No reasonably foreseeable civilian projects would be precluded by any of the collective action alternatives in the Apra Harbor area of Guam.

As shown on Figure 7.5-4, the majority of projects proposed in the southern region of Guam are GovGuam roadway and bridge improvements. The collective action alternatives include various LFTRC configurations associated with NAVMAG. In addition, there would be IT/COMM alignments proposed in the area to support these collective action alternatives. The non-DoD projects are primarily infrastructure improvement projects. No reasonably foreseeable civilian projects would be precluded by any of the collective action alternatives in the southern part of Guam.

The projects that are Guam-wide or not mapped are proposed by GovGuam and consist primarily of infrastructure projects. In some cases, the project site has not been determined. The remaining Guam-wide projects would not be precluded by the collective action alternatives.

The 2010 Final EIS (Volume 7, Chapter 4.3: Recently Completed, Present, and Reasonably Foreseeable Future Actions, pages 4-24 to 4-25) provides additional detail for some of the larger projects, including the Commercial Port Modernization; Pacific Airpower Resiliency, AAFB (formerly known as Intelligence, Surveillance, Reconnaissance, and Strike capability); and Mariana Islands Range Complex MIRC. These descriptions are unchanged.

There were a number of workforce housing projects proposed in anticipation of the H-2B workers that would be brought on-island to support the military relocation as proposed in the 2010 Final EIS, but most of these projects were not constructed or were developed for alternative uses when the construction projects did not materialize. The following sections provide more detail on workforce housing, the DoD Mariana Islands Training and Testing (MITT), and DoD Actions that are not relevant to this SEIS.

7.5.1 Workforce Housing Update

Section 4.1.15 of this SEIS provides a summary of the workforce housing projects. In summary, there was workforce housing to accommodate an estimated 3,700 workers in 2009. Most were located at Harmon Industrial Park. Subsequent to 2009, workforce housing projects were approved or pending approval for an additional capacity of 26,500 workers. Most of these projects were never completed or were converted to rental units. The largest proposal, Ukudu Work Force Village, was initially proposed for 18,000 workers by Younex. A capacity of 1,800 workers was approved and under Phase I of construction, 500 units have been constructed. Phase II would require Younex to fund off-site utility improvements to support the worker population per a Guam Waterworks Association permit condition. There have been some short-term uses of the units for student housing; however, the units are generally vacant.

7.5.2 Mariana Islands Testing and Training

The MITT (project G-23 on Table 7.5-1) is proposed by the U.S Pacific Fleet. An EIS/OEIS is being prepared to evaluate the potential environmental impacts associated with maintaining military readiness training and research, development, testing, and evaluation activities conducted in the MITT study area. The MITT EIS/OEIS is a follow-on study to the MIRC EIS/OEIS, the ROD of which was published in July 2010. The MIRC EIS/OEIS preferred alternative is part of the existing training capability in the MITT EIS/OEIS. The Draft EIS/OEIS was published in September 2013 (NAVFAC Pacific 2013a).

The MITT study area includes the existing MIRC, additional areas on the high seas, and a general transit corridor between Hawaii and MITT where training and testing activities may occur. The MIRC is the only major DON range complex in the MITT study area. The EIS/OEIS supports the renewal of current regulatory permits and authorizations, addresses current training and testing not covered under existing permits and authorizations, and identifies those permits and authorizations necessary to support force structure changes and emerging and future training and testing requirements including those associated with new platforms and weapons systems within the MITT study area, starting in 2015, thereby ensuring critical DoD requirements are met. The MITT study area is predominantly ocean and Guam represents a small part of the total area. Increased training tempo is proposed for the submerged lands that underlie warning area W-517 located south of Guam and small arms firing areas are proposed west of Agat Bay and the Haputo Point area. These proposed actions would restrict public access for recreation during training events. The resource areas addressed in the impact analysis are as follows:

- Sediments and Water Quality
- Air Quality
- Marine Habitats
- Marine Mammals*
- Sea Turtles*
- Marine Birds
- Marine Vegetation
- Marine Invertebrates
- Fish
- Terrestrial Species and Habitats*
- Cultural Resources
- Socioeconomic Resources
- Public Health and Safety

The resources listed above with an asterisk (*) were the primary resources of concern for the cumulative impact analysis. Implementation of the identified past, present, and reasonably foreseeable future actions would result in significant impacts to these resources; however, the contribution of the specific MITT EIS/OEIS no-action and preferred alternatives to the cumulative effects would be low. For example, the impacts of the MITT proposed action on marine mammal and sea turtles were deemed to be minor relative to the mortality or injury due to by catch, commercial ship strikes, entanglement, and ocean pollution. The MITT EIS/OEIS conclusions were not limited to Guam, but encompassed the entire MITT study area. Some characteristics relevant to Guam are summarized below for the two resource areas addressed in detail in the cumulative impact analysis that are relevant to this SEIS.

Sea Turtles: Five species of sea turtles are identified in the MITT study area and the proposed action "may effect, is likely to adversely affect" all five species. No nesting of sea turtles was identified in the study area. Hawksbill turtles are observed around Guam but there are no areas of concentrated occurrence. Green turtles are known to forage around Guam. The MITT proposed action was described as not decreasing the overall fitness of any given population.

Terrestrial Species and Habitats: Conclusions relevant to terrestrial biology include: a) AAFB proposed training is likely to impact Mariana fruit bat, Mariana crow (extirpated), non-ESA listed forest birds, (e.g., Micronesian starling); b) Fena Reservoir training is likely to impact Mariana fruit bat, Mariana common moorhen, Mariana swiftlet, and non-ESA listed forest birds; and c) proposed NMS (referred to as NAVMAG in this SEIS) training is likely to impact Mariana swiftlet, Mariana common moorhen, Mariana fruit bat, vegetation communities, and non-ESA listed forest birds (e.g., yellow bittern). There would be no impact to critical habitat within the Ritidian Unit of the Guam NWR. The EIS/OEIS concludes "although potential impacts on certain bird species from the proposed action could include injury or mortality, impacts are not expected to decrease the overall fitness or result in long-term population-level impacts of any given population"(NAVFAC Pacific 2013a).

7.5.3 Mariana Islands Range Complex Airspace

The MIRC Airspace Final Environmental Assessment/Overseas Environmental Assessment ("MIRC EA/Overseas EA") was published in June 2013 (NAVFAC Pacific 2013b). The document was prepared to specifically address proposed modifications to airspace and sea space within the MIRC. The action alternatives propose expansion of the danger zone and restricted area around Farallon de Medinilla, and creating new airspace warning areas south of Guam and northeast of Saipan. The level of training and testing activities that would occur within the airspace and sea space would remain the same as those assessed in the MIRC EA/Overseas EA's Finding of No Significant Impact, which was published June 15, 2013. The preferred alternative included: extend Restricted Area R-7201 and danger zone at Farallon de Medinilla to 12 nautical miles (22 km) and designate it as R-7201A; and create new warning areas W-11, W-12, and W-13 to replace ATCAAs 1, 2, and 3. Warning areas W-11 and W-12 are south of Guam and ATCAA 6 that overlies Guam would not be affected by the proposed action.

The four resource areas assessed for direct and indirect impacts were: public health and safety; transportation resources; regional economy; and recreation, and no significant impacts were identified. Based on the MIRC EIS/OEIS cumulative impact analysis and direct impact analysis in the EA/Overseas EA, no cumulative impacts were identified.

7.5.4 Other DoD Actions Outside of the Study Area

There are DoD actions that are not included in the cumulative effect assessment because they are located outside of the cumulative effect study area(s). NEPA documents were or are being prepared for the following actions:

- Divert Activities and Exercises EIS (Air Force)
- CNMI Joint Military Training EIS/OEIS (U.S. Pacific Command)

7.6 STEP 6: ASSESS CUMULATIVE EFFECTS

The assessment of cumulative effects was conducted in two steps as follows:

Step 6A: Assess the potential long-term impacts among the recently completed, present, and reasonably foreseeable future projects.

Step 6B: Conduct a cumulative impact analysis of recently completed, present, and reasonably foreseeable future projects in conjunction with collective action alternatives.

7.6.1 Step 6A: Assess the Potential Long-term Impact of Recently Completed, Present, and Reasonably Foreseeable Future Projects

Step 6A assesses the potential for each of the recently completed, present, and reasonably foreseeable future projects listed in Table 7.5-1 to have a long-term adverse or beneficial impact on each resource. The resource impacts for each individual project were presumably considered at the time of their approval. BMPs and permit conditions were presumably implemented to negate adverse impacts to resources. The assessment was necessarily qualitative because of the limited amount of information available for most of the projects. The potential impact of each project on each resource was estimated to be either: adverse, beneficial, or negligible for each resource category. Where projects had both beneficial and adverse aspects regarding impacts within a particular resource category, the predominant long-term impacts were considered. When reviewing project-specific data, the following assumptions were made to guide the assignment of adverse and beneficial impacts:

- Geological and Soil Resources:
  - Implementation of BMPs would minimize construction impacts and there would not be long-term impacts to geological and soil resources due to construction projects.
  - For DoD projects, BMPs and DoD regulations would be fully implemented.
  - On DoD lands, sinkholes would be avoided and appropriate vegetative and/or physical buffers placed to minimize the potential to adversely impact these resources.
  - For non-DoD projects, erosion control plans would be developed and fully implemented, as required by GovGuam.
  - Bank stabilization, erosion mitigation projects, bridge and roadway repairs would have long term beneficial impacts on soils.
  - Some changes in land use may result in permanent long-term reductions in soil loss and sedimentation of nearby surface waters and wetlands, yielding a beneficial impact; however, project specific information often was not available to make this determination.
  - Large-scale development projects would have an adverse impact on topography.

- Water Resources:
  - Implementation of site-specific SWPPPs and associated stormwater BMPs would minimize construction impacts and there would be no long-term impacts to water resources due to construction projects.
  - The USGS numerical groundwater model used to manage the NGLA and the GWRDG (comprised of agencies and other stakeholders) serve to protect water resources.
  - New building construction projects would result in an increase in impervious surfaces that would increase stormwater runoff volume and pollutant loading potential.
  - Implementation of LID measures and BMPs for compliance with local and federal requirements would minimize potential impacts to downstream development, sensitive water resources, and ecology.
  - Unless project information indicated the presence of wetlands, it was assumed none were or would be affected, directly or indirectly.
  - Any improvements to wastewater or potable water infrastructure would have a beneficial impact on water resources.
  - Municipal landfills are heavily regulated and managed to protect water. The assumption is new landfills would not impact water resources.

- Air Quality:
  - Induced traffic or use of fuel-powered stationary equipment associated with operation of a project would have an adverse impact, especially if the project is located within the non-attainment areas.
  - Impacts due to construction would not be long-term impacts on the resource.
  - Power generation based on fossil fuels would adversely impact air quality.
  - Roadway improvement projects would not increase the long-term adverse impacts on air quality, but new roadways, intersections and associated new traffic would impact air quality.

- Noise:
  - Projects such as airfield operations, aviation training, ground-based training, and/or traffic have the potential to generate operational noise levels that may be incompatible with human activity in the vicinity. The impact would be localized.

- Airspace:
  - Airport or airfield improvements reflect a planned increase in air traffic with potential adverse impact on airspace.
  - Tall facilities that are subject to FAA approval regarding air navigation safety would have an adverse impact.

- Land and Submerged Land Use:
  - Projects on DoD land are consistent with base planning.
  - All off-base projects were approved by GovGuam elected officials, commissions or agencies; therefore, they are consistent with land use policies and objectives.
  - Some land uses may be consistent with planning principles but may have siting challenges, such as landfills, power stations, hospitals, and wind turbines. These projects would have an adverse impact.
  - Projects that may restrict public access to a community-valued resource would have an adverse impact.

- Recreational Resources:
  - Projects that create new recreational facilities, such as a new hotel with a golf course, would have a beneficial impact because they expand leisure opportunities and would reduce crowding at other facilities.
  - Projects that are population inducing would increase the number of potential users of recreational sites. This is not an adverse impact unless it would lead to overcrowding that exceeds the site's carrying capacity and enjoyment; however, that level of detail for the projects listed is not available. All population inducing projects would adversely impact recreation assets. Projects that would adversely impact recreational resources include, new subdivisions or workforce housing, new hotels, and new or expanded military missions.

- Terrestrial Biological Resources:
  - Loss or conversion of native habitat would reduce the potential recovery and survival of ESA-listed species creating an adverse impact.
  - Restoration or enhancement of degraded habitat would increase the potential for native species recovery and survival, particularly ESA- and Guam-listed species, and would have a beneficial impact.
  - Reductions and management activities (i.e., fencing, removal) of invasive species and/or feral ungulates or their access to habitat would have a beneficial impact.
  - Projects involving ground disturbance, such as construction of housing or new and widened roadways, would contribute to an adverse cumulative effect. Projects that are renovations or improvements to existing facilities within the existing facility footprint would have no impact on terrestrial biological resources, such as resurfacing a roadway.

- Marine Biological Resources:
  - Stormwater and erosion control BMPs would be implemented for all inland projects. There would be minimal direct impact of a cumulative project to the marine environment.
  - LID measures, described in Section 4.1.2.2 of this SEIS, would be implemented in accordance with the DoD UFC LID (UFC 3-210-10) and Section 438 of the EISA, and would minimize potential impacts to downstream development, sensitive water resources, and ecology.
  - Coastal or nearshore development would have an adverse direct or indirect impact.
  - Development on streams or rivers that flow to the ocean would have an adverse impact; however, projects that appear to be corrective actions would have a beneficial impact on the resource.
  - Wastewater improvement projects would have a beneficial impact on the resource.
  - Population growth-inducing projects would have an adverse impact through recreational pressure and increase demand on wastewater infrastructure. Residential development projects and resort projects would imply an increase in on-island permanent or transient population.
  - Changes to submerged land use that would adversely impact species recovery would be an adverse impact.

- Cultural Resources:
  - Projects that result in adverse effects to historic properties can lead to a cumulative loss of the archaeological and built-historical record that could contribute to an adverse cumulative impact
  - Projects that damage culturally important natural resources can lead to an adverse cumulative impact

  - Projects that lead to reduced access to cultural sites can lead to an adverse cumulative impact.

- Visual Resources:
  - Large new construction that potentially impacts scenic views or vistas would have an adverse impact.
  - Loss of open space is not assumed to be an adverse impact, but large-scale projects would alter the familiar landscape and are potentially adverse.
  - Development on campuses or military bases would not have a visual impact because base planners have reviewed the plans. The exception is projects that are identified as being on the perimeter of a multi-building development.
  - Landfills, wind turbines and other large infrastructure projects would have adverse visual impacts.
  - Restoration of open space or reforestation would have beneficial impacts.

- Ground Transportation:
  - A project that causes LOS to change from acceptable operating conditions to unacceptable conditions (i.e., from LOS A, B, C, D, or E, to LOS F) would contribute to the adverse impact.
  - The following types of projects contribute to deteriorating LOS: new housing projects; public and institutional facilities such power plants, health clinics, and schools; hotel and tourism-related structures; and projects in existing congested areas.
  - Road improvement projects would provide a beneficial cumulative effect on traffic LOS.

- Marine Transportation:
  - Projects that repair existing port facilities would have a beneficial impact because it is assumed it would allow the facility to operate more effectively or efficiently thereby increasing capacity.
  - Projects that expand port capacity, directly or indirectly, would have a beneficial impact.
  - More vessels do not equate to an adverse impact. If demand exceeds capacity to accommodate vessels, market forces or government action would respond accordingly.
  - Projects that facilitate an increase in on-island population would have an adverse impact on marine transportation.

- Utilities:
  - New development is subject to GovGuam agency building permit review. Projects would not be approved unless their utility requirements can be met.
  - Recently completed and present projects would have already been approved or conditionally approved. The utility capacity to support the projects was presumably deemed adequate.
  - Recently completed, present, and reasonably foreseeable utility improvement projects would be beneficial impacts.
  - Reasonably foreseeable population inducing plans or programs would have an indirect adverse impact on utility capacity The *Utilities* direct and indirect impact analysis on infrastructure capacity addresses population growth and planned DoD projects through 2028; therefore, there may be an overestimate of the potential for cumulative impact on utilities in this chapter.

- Socioeconomics and General Services:
  - A project is considered to have an adverse cumulative effect if: it has the potential to add 2% or more at any point in time to expected population or economic levels; it would cause

substantial increases in staffing, new or physically altered facilities, and/or equipment/vehicles; or it affects public safety or order.
    - Projects that preserve or enhance the social fabric would have a beneficial cumulative effect.
    - The following types of projects would provide a beneficial cumulative effect: housing projects; public and institutional facilities such power plants, health clinics, and schools; and hotel and tourism-related structures.

- Hazardous Materials and Waste:
    - Hazardous material, hazardous waste and POL storage, use and transport are heavily regulated; therefore, most recent, present of future development projects would not have a significant adverse impact on hazardous material management.
    - Projects that would introduce a new type of material requiring special handling or on Guam would result in a potential adverse impact.
    - New industrial uses or relocation of industrial uses would have an adverse impact.
    - Remedial actions or repair of storage facilities would have a beneficial impact.
    - Demolition projects may generate lead, asbestos or PCB waste resulting in an increase in the quantity of these materials to be managed on island. This would be a potential adverse impact for non-DoD projects. DoD has sufficient demolition waste capacity and regulated; therefore, no impact would result from DoD demolition projects.
    - Projects that characterize potentially contaminated sites would have a beneficial impact because the site would be better managed with this information.
    - Projects that would increase the volume of hazardous material or POL transported to/on Guam or the amount of waste to be managed would have an adverse impact.

- Public Health and Safety:
    - Projects that would adversely affect regional traffic, noise, and water quality.
    - Projects that would result in a perception that increasing the military presence on Guam causes the island to be a more likely target for terrorist threat.
    - Projects that would subject the public to increased or decreased risk of contracting a disease or experiencing personal injury.
    - Projects with the potential to increase or decrease the occurrence of notifiable diseases would result resulting in an adverse impact to Guam health care services.
    - The following types of projects provide a beneficial cumulative effect: road, power, sewer, water infrastructure improvements, and hospitals and clinics.

- Environmental Justice and the Protection of Children:
    - Non-luxury housing projects and resorts would provide a beneficial cumulative effect for the low-income population by increasing the total supply of housing and creating additional, non-specialized jobs.
    - Projects that improve public services and infrastructure would have a beneficial impact.
    - Renovation/remodeling projects on military bases would not impact environmental justice populations, but growth-inducing mission changes would.

The results of the assessment are presented in Table 7.6-1, which contains the same list of projects that were presented in Table 7.5-1, but the resource column headings have replaced the project description information headings. The total number of projects (i.e., recently completed, present, and reasonably foreseeable) that could contribute to the cumulative effect is tallied and reported in the last rows of Table 7.6-1.

The resources most likely to be adversely affected by projects are terrestrial biology and cultural. This is largely due to that fact that most projects would result in ground disturbance and potential for removal or disturbance of habitat and cultural resources.

The resource areas that benefit most from the projects listed are ground transportation, utilities, socioeconomics and general services, public health and safety and environmental justice. This is because many of the GovGuam projects are capital improvement projects designed to support the health and safety of the community.

A nearly equal number of projects have adverse (marked as X in the Table) and beneficial impacts (shown as B) were identified for geological and soil resources, and water resources. Air quality, noise, airspace land use, recreational resources and marine transportation resource areas are impacted by fewer projects than other resource areas, either beneficially or adversely.

Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																		
				Geological and Soil Resources	*Water Resources*	*Air Quality*	*Noise*	*Airspace*	*Land and Submerged Land Use*	*Recreational Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Cultural Resources*	*Visual Resources*	*Ground Transportation*	*Marine Transportation*	*Utilities*	*Socioeconomics and General Services*	*Hazardous Materials and Waste*	*Public Health & Safety*	*Environmental Justice and the Protection of Children*
Guam - General Actions (G) (not mapped)																						
G-1	GovGuam	Road Safety Improvements	RC	B	B						X		X		B					B	B
G-2	COMNAV Pacific	MIRC EIS/OEIS	RC			X	X		X		X	X	X						X		X
G-3	Air Force	MIRC Airspace	P					X													
G-4	GovGuam	Traffic Signal System Upgrade, Island-wide	RF												B					B	
G-5	GovGuam	Upgrade 14 Megavolt Ampere Power Transformer To 30 Megavolt Ampere And Underground Line	RC						B		X		X	B			B			B	B
G-6	GovGuam	60 MW Power Plant	RF		X	X			X		X		X	X			B	B	X	B	B
G-7	Rubio & David	Health Clinic	P		X						X		X	X	X			B		B	B
G-8	Carlos & Rosemarie Takano	Multi-Family Dwelling	P		X					X	X		X	X				B			B
G-9	GovGuam	Pole Hardening	P																	B	B
G-10	GovGuam	Territorial Prison	RF		X				X		X		X	X				B		B	B

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; X = adverse; B = beneficial.

Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																	
				Geological and Soil Resources	*Water Resources*	*Air Quality*	*Noise*	*Airspace*	*Land and Submerged Land Use*	*Recreational Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Cultural Resources*	*Visual Resources*	*Ground Transportation*	*Marine Transportation*	*Utilities*	*Socioeconomics and General Services*	*Hazardous Materials and Waste*	*Public Health & Safety*	*Environmental Justice and the Protection of Children*
G-11	GovGuam	Lateral Conversion Of Power Lines To Underground Lines	P						B		X		X	B			B			B	B
G-12	GovGuam	Wastewater System Planning	P		B							B					B				B
G-13	GovGuam	Facilities Plan / Design for WWTP	P		B							B					B			B	B
G-14	GovGuam	Groundwater Disinfection	RC		B												B			B	B
G-15	GovGuam	Water Booster Pump Station	P		B						X		X				B			B	B
G-16	GovGuam	Implement Groundwater Rule	RC		B												B			B	B
G-17	GovGuam	Deep Well Rehabilitation	RC		B						X		X				B			B	B
G-18	GovGuam	Water Wells	P		B						X		X				B			B	B
G-19	GovGuam	Wastewater Collection System Replacement/Rehabilitation Program	P		B						X	B	X				B			B	B
G-20	GovGuam	LS Priority 1 Upgrades	P		B							B					B			B	B

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; X = adverse; B = beneficial.

Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																	
				Geological and Soil Resources	*Water Resources*	*Air Quality*	*Noise*	*Airspace*	*Land and Submerged Land Use*	*Recreational Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Cultural Resources*	*Visual Resources*	*Ground Transportation*	*Marine Transportation*	*Utilities*	*Socioeconomics and General Services*	*Hazardous Materials and Waste*	*Public Health & Safety*	*Environmental Justice and the Protection of Children*
G-21	GovGuam	WWTP Priority 1 Upgrades	P		B							B					B			B	B
G-22	GovGuam	Water Distribution Pipe Replacement	P		B							B					B			B	B
G-23	NAVFAC Pacific	MITT	P					X	X	X	X	X				X					
Guam - North (N)																					
N-1	GovGuam	Route 29 Reconstruction	RF	X	X						X		X		B					B	B
N-2	Base Corp.	Paradise Estates, Yigo	RC	X	X					X	X		X		X			B			B
N-3	GovGuam	Route 15 Embankment Restoration	RC	X	X						X		X		B					B	B
N-4	Air Force	NWF Perimeter Fence/Road	RC								X		X							B	
N-5	Air Force	PRTC Combat Support Vehicle Facility	RC		X						X		X						X		
N-6	Air Force	PRTC Commando Warrior Ops Facility	RC		X						X		X								
N-7	Air Force	Strike FOL Electrical Infrastructure	RC								X		X				B				
N-8	GovGuam	Skatepark Barrier/Iglesia Circle Traffic Signal	RC												B					B	
N-9	DON	Postal Service Center	RC		X						X		X								B

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; X = adverse; B = beneficial.

Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																		
				Geological and Soil Resources	*Water Resources*	*Air Quality*	*Noise*	*Airspace*	*Land and Submerged Land Use*	*Recreational Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Cultural Resources*	*Visual Resources*	*Ground Transportation*	*Marine Transportation*	*Utilities*	*Socioeconomics and General Services*	*Hazardous Materials and Waste*	*Public Health & Safety*	*Environmental Justice and the Protection of Children*
N-10	Pacific International Guam Inc.	Workforce Housing	RC	X	X					X	X	X	X	X	X	X	X	B			X
N-11	Air Force	South Ramp Utilities Phase 2	RC		B						X		X				B					
N-12	Air Force	PRTC Commando Warrior Barracks	RC		X						X		X			X	X					
N-13	Air Force	PRTC Commando Communication Ops Facility	RC		X						X		X									
N-14	Air Force	Strike Operations Group Facility	RC		X						X		X									
N-15	DON	Release a Guam Land Use Plan 77 parcel near South Finegayan	RC						B									B			B
N-16	Air Force	Milky Way Site for Multiple Threat Emitter System	RC		X						X		X									
N-17	GovGuam	North Guam Signalization	RC												B					B	B
N-18	Air Force	Conventional Munitions Maintenance Facility	RC		X						X		X						X			

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Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																	
				Geological and Soil Resources	*Water Resources*	*Air Quality*	*Noise*	*Airspace*	*Land and Submerged Land Use*	*Recreational Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Cultural Resources*	*Visual Resources*	*Ground Transportation*	*Marine Transportation*	*Utilities*	*Socioeconomics and General Services*	*Hazardous Materials and Waste*	*Public Health & Safety*	*Environmental Justice and the Protection of Children*
N-19	Air Force	Clear Water Rinse Facility	RC		B						X		X							B	
N-20	Air Force	PRTC Combat Communication Support Facility	RC		X						X		X								
N-21	Air Force	PRTC Combat Communication Transmission System Facility	RC		X						X		X				B				
N-22	Air Force	PRTC RH Cantonment Operations Facility	RC		X						X		X								
N-23	Air Force	Air Freight Terminal Complex	RC		X			X			X		X			B					
N-24	Air Force	Ungulate Fencing	RC			B					B	B	X								B
N-25	Air Force	Beddown of Training and Support Initiatives at NWF	P		X		X			X	X	X	X		X			B	X	X	X
N-26	Air Force	Pacific Airpower Resiliency, AAFB	P		X	X	X	X			X	X	X		X	X	X		X	X	
N-27	Air Force	AT/FP Perimeter Fence and Road Construction and Main Gate Relocation at AAFB	RC								X		X	X	B				X		

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Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																	
				Geological and Soil Resources	*Water Resources*	*Air Quality*	*Noise*	*Airspace*	*Land and Submerged Land Use*	*Recreational Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Cultural Resources*	*Visual Resources*	*Ground Transportation*	*Marine Transportation*	*Utilities*	*Socioeconomics and General Services*	*Hazardous Materials and Waste*	*Public Health & Safety*	*Environmental Justice and the Protection of Children*
N-28	Younex Enterprises LLC	Ukudu Workforce Village	RC	X	X					X		X	X	X	X	X	X	X	B	X	B	X
N-29	Sung Kim	Small Commercial Development	P		X						X		X	X	X			B			
N-30	Air Force	South Ramp U&SI II	P		B						X		X				B				
N-31	GovGuam	Lada Estates - Low Income Affordable Housing	RC	X	X					X	X	X	X	X	X			B			B
N-32	GovGuam	Northern District WWTP Phases 1-3	P		B						X	B	X				B			B	B
N-33	Air Force	PRTC Combat Command Facility	P		X						X		X								
N-34	Air Force / DON	Dispersed Maintenance Spares & SE Storage Facility	RF								X		X								
N-35	Golden Gate Services LLC	Single Family Homes	P		X					X	X		X	X	X			B			B
N-36	TRI Inc.	Paradise Meadows	P	X	X					X	X		X	X	X			B			B
N-37	GDPW	Jinapsan Road	P	X	X				B	B	X	X			B			B			
N-38	Guam Healthcare Development	Guam Regional Medical City	P	X	X				X		X		X	X	X			B		B	B

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Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																	
				Geological and Soil Resources	*Water Resources*	*Air Quality*	*Noise*	*Airspace*	*Land and Submerged Land Use*	*Recreational Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Cultural Resources*	*Visual Resources*	*Ground Transportation*	*Marine Transportation*	*Utilities*	*Socioeconomics and General Services*	*Hazardous Materials and Waste*	*Public Health & Safety*	*Environmental Justice and the Protection of Children*
N-39	Army	Terminal High Altitude Area Defense	P		X			X		X	X		X						B	X	X
N-40	Air Force	Munitions Storage Igloos AAFB Guam	P		X						X		X						B	X	
N-41	Vantage Group	Villa Pacita Estates	P	X	X					X	X		X	X	X			B			B
N-42	GovGuam	Relocation of Dededo Flea Market and Construction of Farmer's Co-op	P	X							X		X	X	X			B			
N-43	Hawaiian Rock Products	Infrastructure Construction	P								X		X		B					B	B
N-44	DON	North Ramp Parking Apron	P				X	X			X		X		B						
N-45	Air Force	Personnel Protection - Hardened Command Post	P																	X	
N-46	Air Force	Create Broad Area Maritime Surveillance Capability	P														B				
N-47	Air Force	POL System Hardened Structures	P								X		X						B		B
N-48	Air Force	Tactical Missile Maintenance Facility	P		X						X		X							X	

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; X = adverse; B = beneficial.

Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																	
				Geological and Soil Resources	*Water Resources*	*Air Quality*	*Noise*	*Airspace*	*Land and Submerged Land Use*	*Recreational Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Cultural Resources*	*Visual Resources*	*Ground Transportation*	*Marine Transportation*	*Utilities*	*Socioeconomics and General Services*	*Hazardous Materials and Waste*	*Public Health & Safety*	*Environmental Justice and the Protection of Children*
N-49	Air Force	PRTC RH Airfield Operations	P			X	X				X		X								
N-50	Air Force	PRTC SF Fire Rescue Emergency Management	P																B	B	
N-51	Air Force	Fuel System Maintenance. Hangar, Inc.2	P								X		X						X		
N-52	Air Force	General Purpose Hangar	P								X		X								
N-53	Air Force	AGE Covered Facility	P		X						X		X								
N-54	Air Force	PRTC RH Logistics Facility	P		X						X		X								
N-55	Air Force	PRTC Combat Communication Infrastructure Facility	P		X						X		X								
Guam - Central (C)																					
C-1	GDPW	Route 15 Resurfacing	RC								X		X		B					B	B
C-2	Access Development Company	Talo Verde Estates	RC	X	X					X	X		X	X	X			B			B
C-3	Office of Veterans Affairs	Veterans Clinic	RC		X						X		X	X	X			B	X	B	B

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; X = adverse; B = beneficial.

Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																	
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C-4	Tanota Partners (Ysrael family)	Hotel Construction Bayview 5 Luxury Project, Tumon Bay	RC	X	X					X	X	X	X	X	X	X	X	B			
C-5	GovGuam	Route 1 U-Turn Reconstruction	RC												B					B	B
C-6	GovGuam	Route 25 (Alageta Road)	RC	B	B						X		X		B					B	B
C-7	DLA	Replace Gas Cylinder Storage Facility	RC								X		X						B		
C-8	DON	Naval Hospital Replacement	RC	X	X		X	X	X		X		X					B		B	B
C-9	GUANG	NG Readiness Center	RC		X						X		X					B	B		
C-10	GUANG	DRBS Storage Facility	RC		X						X		X								
C-11	GUANG	Combined Support Maintenance Facility	RC		X						X		X						X		
C-12	Tagada Guam LLC	Amusement Park-Tumon	RC	X	X				X	B	X		X	X				B			B
C-13	GovGuam	Student Center	RC		X					B	X		X					B			B
C-14	GovGuam	Route 6A Murray Road	RC	X	X						X		X		B					B	B

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C-15	GovGuam	Route 16 Guam Main Facility Post Office / Army National Guard Intersection	RC			X					X		X		B					B	B
C-16	GovGuam	Route 8/10/16 Tri-Intersection	RC			X					X		X		B					B	B
C-17	GovGuam	DNA Forensic Lab	RC		X						X		X					B		B	
C-18	GovGuam	Foundation Building	RC		X						X		X					B			
C-19	GovGuam	Gregorio D. Perez Dock A & B Steel Pile Extension & Water Blasting	RC									X	X			B					B
C-20	GovGuam	Fiber Optic Installation	RC								X		X				B				B
C-21	Access Development Company	Emerald Ocean View Park	P	X	X					X	X	X	X	X	X	X	X	B			B
C-22	GovGuam	Guam Memorial Hospital Emergency Room Expansion	P								X		X					B		B	B
C-23	GovGuam	Ordot Dump Closure Construction and Dero Road Sewer Improvements	P		B				B								B	B		B	

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Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																	
				Geological and Soil Resources	*Water Resources*	*Air Quality*	*Noise*	*Airspace*	*Land and Submerged Land Use*	*Recreational Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Cultural Resources*	*Visual Resources*	*Ground Transportation*	*Marine Transportation*	*Utilities*	*Socioeconomics and General Services*	*Hazardous Materials and Waste*	*Public Health & Safety*	*Environmental Justice and the Protection of Children*
C-24	GovGuam	Guam Museum	P						B	B	X		B	X				B			
C-25	Laguna at Pago Bay Resort	Upscale Residential Development	P	X	X					X	X		X	X	X			B			B
C-26	GHURA	Sagan Bonita	RC	X	X					X	X		X	X	X			B			B
C-27	Orion Construction	Island Surgical Center	P		X				X		X		X	X	X			B		B	B
C-28	GHURA	Summer Green Residences	P	X	X					X	X		X	X	X			B			B
C-29	GovGuam	Route 1-8 Intersection Improvements & Agaña Bridges Replacement	P	B	B						X		X		B					B	B
C-30	GovGuam	Rehabilitation of Asan Springs	P		B						X		X				B			B	B
C-31	GovGuam	Route 26/25 Intersection Improvements	RF	B	B						X		X		B					B	B
C-32	UoG	Wind Turbine	P			B		X	X		X		X	X			B			B	B
C-33	UoG	Field House Renovation	RC								X		X					B			B
C-34	Access Development Company	Hemlani Apartments	P	X	X					X	X		X	X	X			B			B
C-35	GovGuam	Guam Airport Project	RF		X		X	X			X		X					B		X	B

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Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																		
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C-36	GovGuam	Route 26 Reconstruction & Widening, Route 1 to Route 25	RF	B	B						X		X		B					B	B
C-37	GovGuam	Route 10A, Rehabilitation & Widening, Sunset Blvd. to Route 16	RF	B	B						X		X		B					B	B
C-38	GovGuam	Runway Rehabilitation and Expansion	P			X		X			X		X							B	B
C-39	GovGuam	Gregorio D. Perez Marina Renovation & Site Improvement Project	P							B		X	X	X		B					B
C-40	GovGuam	Gregorio D. Perez Marina Dock C Repairs	P							B		X	X			B					B
C-41	GovGuam	Facilities Plan for Hagåtña STP Improvements & Effluent Wastewater Pump Station	P		B							B					B			B	B
C-42	GovGuam	Hagåtña STP Improvements and Effluent Wastewater Pump Station	P		B						X	B	X				B			B	B

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Table 7.6-1. Summary of Potential Long-Term Impacts of Recently Completed, Present, and Reasonably Foreseeable Future Projects on Resource Areas

ID #	*Lead Agency or Proponent*	*Project Name*	*Recently Completed (RC), Present (P), or Reasonably Foreseeable (RF)*	*Potential Long-Term Impacts to Resources*																	
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C-43	GovGuam	Agaña STP Interim Measures	P		B						X	B	X				B			B	B
C-44	DLA	Upgrade Fuel Pipeline	P								X		X						B	B	B
C-45	GUANG	Assembly Hall	P								X		X								B
C-46	GovGuam	Route 8/Canada Toto Loop Road Intersection Improvements	P	B	B						X		X		B					B	B
C-47	Guam Highlands Investment Group	Sigua Highlands / near Leopalace	RF	X	X					X	X		X	X	X		X	B			B
C-48	GovGuam	Tiyan Parkway, Phase 1	P	B	B						X		X		B					B	B
C-49	GovGuam	Route 14B (Ypao Road) Reconstruction & Widening, Route 1 to Route 14	P	B	B						X		X		B					B	B
C-50	GovGuam	Route 10A, Route 1 GIA/Tiyan Intersection	RF	B	B						X		X		B					B	B
C-51	GovGuam	Route 7A Rehabilitation	RC	B	B						X		X		B					B	B

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C-52	GovGuam	Route 4, McDonalds to Route 10	RC	B	B						X		X		B					B	B
C-53	GovGuam	Repair Finegayan Road-Harmon Cutoff	RF	B	B						X		X		B					B	B
Guam - Central Apra Harbor (AH)																					
AH-1	CNM	Orote Magazines (P-425)	P		X						X		X						X	B	X
AH-2	GovGuam	Reforestation of Masso Reservoir	P	B	B	B					B	B	X	B							B
AH-3	GovGuam	Masso River Bridge Embankment	RC	B	B						X	B	X		B					B	B
AH-4	CNM	Kilo Wharf Extension (P-502)	RC									X				B			X	X	
AH-5	DON	CSS-15 HQ Facility	RC		X						X		X								
AH-6	DON	Replace Family Housing Units	RC								X		X								
AH-7	DON	NEX Minimart and Gas Station	RC		X						X		X								
AH-8	GovGuam	Route 11 Improvements and Shore Protection	P	B	B						X	B	X		B					B	B
AH-9	GovGuam	Asan and Aguada Bridge Rehabilitation	RF		B										B					B	B

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AH-10	CNM	X-Ray Wharf Improvements (P-518)	RF								X	X				B			X	X	
AH-11	GovGuam	Modernization Program: Port Reconfiguration, Maintenance and Repair	P			X					X	X	X		X	B		B	B	B	B
AH-12	GovGuam	Comprehensive Port-wide Closed Caption Television System	P								X		X				B				
AH-13	GovGuam	Marine & Port Security Operations Center	P		X						X	X	X			B				B	B
AH-14	GovGuam	Emergency Backup Generators	P			X											B			B	B
AH-15	GovGuam	Load Center 4 Building Roof Repair	RC																	X	B
AH-16	GovGuam	Construction of Golf Pier Pipeline Replacement	RC		X							B							B	X	B
AH-17	GovGuam	Redesign of existing outdoor substation to indoor type.	RC								X		X				B			B	B
AH-18	GovGuam	Substation Transformer Upgrade with concrete fence	RC								X		X				B			B	B

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AH-19	DON	Wholehouse Revitalization I	P																		
AH-20	DON	Wholehouse Revitalization II	P																		
AH-21	DON	Romeo Wharf Improvements	P									X				B					
AH-22	DON	Emergent Repair Facility Expansion (P-566)	P		X						X		X							B	
AH-23	DON	Dehumidify Supply Storage Facility	P		X						X		X								
Guam - South (S)																					
S-1	GovGuam	Route 2 - Culverts and Slide Repair	RC	B	B						X	B	X		B					B	B
S-2	GovGuam	Talofofo / Togcha Bridge Rehabilitation	RC	B	B						X	B	X		B					B	B
S-3	GovGuam	Layon Landfill, Dandan	RC	B	B		X		X		X		X	X	X		B	B	X	B	B
S-4	GovGuam	15 MW Solar / Wind Turbine	P			B		X	X		X		X	X			B			B	B
S-5	GovGuam	Santa Rita Springs Booster Pump Rehabilitation, Phase II	P		B							B					B			B	B
S-6	GovGuam	Ugum Water Treatment Plant Refurbishment	RC		B							B					B			B	B

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S-7	GovGuam	Brigade II (Ugum Lift) Booster Pump Station Upgrade	P		B							B					B			B	B
S-8	GovGuam	Ugum Water Treatment Plant Intake Modifications	P		B							B					B			B	B
S-9	GovGuam	Ugum Water Treatment Plant Reservoir Replacement	P		B						X	B	X				B			B	B
S-10	GovGuam	Old Agat Wastewater Collection (Phase II)	P		B							B					B			B	B
S-11	GovGuam	Umatac-Merizo STP Improvements	RC		B							B					B			B	B
S-12	GovGuam	Old Agat Collection Continuation (Phase III)	P		B							B					B			B	B
S-13	GovGuam	Facilities Plan / Design / Interim for Baza Gardens STP Improvements	RC		B							B					B			B	B
S-14	GovGuam	Baza Gardens STP Replacement	P		B							B					B			B	B

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S-15	GovGuam	Agat / Santa Rita STP Replacement	P		B							B					B			B	B
S-16	GovGuam	Agat Marina Dock A Repair & Renovation	P		B					B		X				B			X		B
S-17	GovGuam	Facilities Plan / Design / Interim for the Umatac-Merizo STP	RC		B							B					B			B	B
S-18	GovGuam	Umatac-Merizo STP Replacement	RF		B							B					B			B	B
S-19	GovGuam	Agfayan Bridge Replacement	P	B	B						X		X		B					B	B
S-20	GovGuam	Route 4, Togcha River to Ipan Beach Park	P	B	B						X		X		B					B	B
S-21	GovGuam	Route 17, Route 5 to Chalan Tun Ramon Baza, Phase 2A	P	B	B						X		X		B					B	B
S-22	GovGuam	Inarajan North Leg (As-Misa) Bridge Rehabilitation	P	B	B						X		X		B					B	B
S-23	GovGuam	Bile & Pigua Bridges Replacement	P	B	B						X		X		B					B	B
S-24	GovGuam	Ajayan Bridge Replacement	P	B	B						X		X		B					B	B

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S-25	GovGuam	Route 4, Merizo Bridge Approach Restoration	P	B	B						X		X		B					B	B
S-26	GovGuam	Aplacho Bridge Replacement	P	B	B						X		X		B					B	B
S-27	GovGuam	Route 17 Rehabilitation & Widening, Route 5 to Route 4A, Phase 2B	RF	B	B						X		X		B					B	B
S-28	GovGuam	Route 4 Curve Widening, Ylig Bridge to Dandan Road	RF	B	B						X		X		B					B	B
S-29	GovGuam	Route 5 Rehabilitation & Widening, Route 2A to Route 12	RF	B	B						X		X		B					B	B
S-30	GovGuam	Route 17 Rehabilitation and Widening, Route 4 to Chalan Tun Ramon Baza	RC	B	B						X		X		B					B	B
S-31	GovGuam	Route 4, Ylig Bridge to Pago Bay	P	B	B						X		X		B					B	B

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S-32	GovGuam	Route 17 Drainage Culverts and Rehabilitation	RC	B	B						X		X		B					B	B
S-33	GovGuam	Taleyfak Bridge Restoration	RC												B					B	
S-34	GovGuam	Tanaga Bridge Permanent Restoration	RC												B					B	
S-35	DON	Cetti Bay Reforestation	P	B	B							B									
Number of recently completed projects potentially contributing to cumulative effects (X/B)			76	11/ 10	33/ 19	3/1	3/0	2/0	4/2	7/2	58/1	7/9	61/0	10/1	9/20	2/3	0/15	0/ 17	9/3	3/ 36	3/43
Number of present projects potentially contributing to cumulative effects (X/B)			95	9/16	56/ 40	5/3	4/0	8/0	5/4	11/5	67/1	7/23	67/1	17/2	15/ 17	5/6	0/29	0/19	5/6	5/ 52	3/63
Number of reasonably foreseeable projects potentially contributing to cumulative effects (X/B)			18	2/8	5/10	1/0	1/0	1/0	2/0	1/0	15/0	1/1	14/0	3/0	1/11	0/1	1/2	0/4	2/0	2/14	0/15
Total number of projects contributing to cumulative effects (X/B)			188	22/ 34	94/ 69	9/4	8/0	11/0	11/6	19/7	140/2	15/ 33	142/ 1	30/3	25/ 48	7/10	1/46	0/ 40	16/9	10/102	6/ 121

Legend: RC = recently completed; P = present; RF = reasonably foreseeable; STP = Sewage Treatment Plant; X = adverse; B = beneficial.

7.6.2 Step 6B: Cumulative Impact Analysis of Recently Completed, Present, and Reasonably Foreseeable Future Projects in Conjunction with Collective Action Alternatives

Based on Table 7.6-1, every resource area was or would potentially be impacted by the recently completed, present, and reasonably foreseeable future projects. Table 7.6-2 summarizes the SEIS collective action alternatives (Cantonment/Family Housing + LFTRC + Additive Actions + 2010 ROD-Related Action) impacts from Table 7.4-1. The impacts are simplified to the highest level of significance identified for any criteria under each resource. For example, significant impacts (SI) were identified for geological and soil resources due to the permanent alteration of topography for all alternatives.

The second to the last row of Table 7.6-2 indicates whether the collective action alternatives in combination with the recently completed, present, and reasonably foreseeable future projects could affect the health of the resource or trend associated with the resource. In other words, is there a potential for a cumulative effect? For all resources, if the finding is "yes" there is potential for cumulative effect.

The final row of Table 7.6-2 indicates the magnitude of the cumulative effect (e.g., strong, moderate or low). The magnitude is a function of the current health of the resource, the potential for the resource to sustain its current health if stressed, the geographic extent of the impact, the duration of the impact and a demonstration of cause and effect. The magnitude of the cumulative effect on a specific resource is not necessarily the sum of the effects of all actions, because there may be no cause and effect relationship. For example, a noise level that exceeds the established thresholds for significance in one geographic area would not cause an additive noise impact to a similar noise impact in another geographic area. In contrast, the recovery of a threatened and endangered species could be affected by incremental permanent losses in total available suitable habitat.

The assessment is based on long-term impacts of the proposed action (or collective action) on a resource. The assessment of magnitude is complicated by the consideration of both adverse and beneficial impacts. This is especially true for complex resources with multiple criteria like socioeconomics and environmental justice. The following are general descriptions of strong, moderate and low magnitudes, but the rationale varies with each resource:

- A "Strong" magnitude is applicable to resources where the present and reasonably foreseeable actions plus the collective action alternatives are likely to have an additive significant adverse impact on a resource. These are resources that warrant the establishment of thresholds for their protection or have an island-wide geographic extent. "Strong" is applicable when additive impacts would be impossible to reverse over time, such as the loss of a cultural site.
- A "Moderate" magnitude is assigned when the significant adverse impacts due to the present and reasonably foreseeable actions plus the collective action alternatives are not Guam-wide but could adversely impact a region or community. There may be regulatory thresholds that are exceeded, but they are specific to a location. The long-term impacts could be reversed or mitigated with appropriate resources (i.e., finances, time, expertise). An example is utilities infrastructure where the additive electrical demand could exceed the supply, but infrastructure upgrades would reverse the impact and specific projects have been programmed to eliminate the adverse impact.
- A "Low" magnitude of additive impact is assigned when there is no threshold established for the health of the resource, the threshold is very high or the resource is healthy and resilient to stressors. There is no nexus between the impacts of the proposed action and the impacts of the present and reasonably foreseeable actions. For example, the proposed action may limit public access to GovGuam land and result in a significant direct impact, but present and reasonably

foreseeable projects may not restrict access, so the additive impact among the actions would be low. Generally, the impacts are localized and readily reversible when the project is no longer operational. Impacts on ambient air quality would be considered low, except within a non-attainment area or if the project results in a new non-attainment area.

Table 7.6-2 summarizes the magnitude for each resource and the rationale is presented in the subsequent resource sections under *Potential Cumulative Effects*.

Table 7.6-2. Potential for Cumulative Effects

SEIS Collective Action Alternative	*Highest Level of Significance Identified for Each Resource (Summarized from Table 7.4-1)*																	
	Geology and Soil Resources	*Water Resources*	*Air Quality*	*Noise*	*Airspace*	*Land and Submerged Land Use*	*Recreational Resources*	*Terrestrial Biological Resources*	*Marine Biological Resources*	*Cultural Resources*	*Visual Resources*	*Ground Transportation*	*Marine Transportation*	*Utilities (Potable Water, Wastewater)*	*Socioeconomics and General Services (Population Change)*	*Hazardous Materials and Waste*	*Public Health & Safety (Operational Safety)*	*Environmental Justice and the Protection of Children*
A-1	SI	SI-M	LSI	SI-M	SI-M	SI	SI	SI-M	LSI	SI-M	SI-M	SI-M	LSI	SI-M	SI	LSI	LSI	SI-M
A-2, 3, 4	SI 2=LSI	SI-M	LSI	LSI	SI-M	SI 3=LSI	LSI	SI-M	LSI	SI-M	SI 2=LSI	SI-M	LSI	SI-M	SI	LSI	LSI	SI-M
A-5	SI	SI-M	LSI	LSI	SI-M	SI	LSI	SI-M	LSI	SI	LSI	SI-M	LSI	SI-M	SI	LSI	LSI	SI-M
B-1	SI	SI-M	LSI	SI-M	SI-M	SI	SI	SI-M	LSI	SI-M	SI-M	SI-M	LSI	SI-M	SI	LSI	LSI	SI-M
B-2, 3, 4	SI 2=LSI	SI-M	LSI	LSI	SI-M	SI 3=LSI	LSI	SI-M	LSI	SI-M	SI 2=LSI	SI-M	LSI	SI-M	SI	LSI	LSI	SI-M
B-5	SI	SI-M	LSI	LSI	SI-M	SI	LSI	SI-M	LSI	SI	LSI	SI-M	LSI	SI-M	SI	LSI	LSI	SI-M
C-1	SI	SI-M	LSI	SI-M	SI-M	SI	SI	SI-M	LSI	SI-M	SI-M	SI	LSI	SI-M	SI	LSI	SI	SI-M
C-2, 3, 4	SI 2=LSI	SI-M	LSI	LSI	SI-M	SI 3=LSI	LSI	SI-M	LSI	SI-M	SI 2=LSI	SI	LSI	SI-M	SI	LSI	SI	SI-M
C-5	SI	SI-M	LSI	LSI	SI-M	SI	LSI	SI-M	LSI	SI	LSI	SI	LSI	SI-M	SI	LSI	SI	SI-M
D-1	SI	SI-M	LSI	SI-M	SI-M	SI	SI	SI-M	LSI	SI-M	SI-M	SI	LSI	SI-M	SI	LSI	LSI	SI-M
D-2, 3, 4	SI 2=LSI	SI-M	LSI	LSI	SI-M	SI 3=LSI	SI	SI-M	LSI	SI-M	SI 2=LSI	SI	LSI	SI-M	SI	LSI	LSI	SI-M
D-5	SI	SI-M	LSI	LSI	SI-M	SI	SI	SI-M	LSI	SI-	LSI	SI	LSI	SI-M	SI	LSI	LSI	SI-M
E-1	SI	SI-M	LSI	SI-M	SI-M	SI	SI	SI-M	LSI	SI-M	SI-M	SI	LSI	SI-M	SI	LSI	LSI	SI-M
E-2, 3, 4	SI	SI-M	LSI	LSI	SI-M	SI 3=LSI	LSI	SI-M	LSI	SI-M	SI 2=LSI	SI	LSI	SI-M	SI	LSI	LSI	SI-M
E-5	SI	SI-M	LSI	LSI	SI-M	SI	LSI	SI-M	LSI	SI-	LSI	SI	LSI	SI-M	SI	LSI	LSI	SI-M
Does the collective action alternative (SEIS + Additive Actions + 2010 ROD-Related Action) in combination with past, present and reasonably foreseeable projects impact the health of the resource? i.e., is there a potential cumulative effect? Yes [Y] / No [N]																		
	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
What is the magnitude of the additive impact of the collective action in conjunction with past, present, and reasonably foreseeable projects? S - strong; M - moderate; L - low																		
	L	S	L	L	L	L	M	S	L	S	L	S	L	M	M	L	M	S

Legend: NI = No impact; LSI = Less than significant impact; SI = Significant impact; SI-M = Significant and mitigable to less than significant. Cantonment/family housing alternatives: A= Finegayan, B= Finegayan and South Finegayan, C = AAFB, D = Barrigada. LFTRC alternatives: 1 = Route 15; 2, 3, and 4 = NAVMAG alternatives; 5 = NWF; Blue shading = Preferred Alternative; red font = SI or SI-M.

7.7 STEPS 7 AND 8: REPORT RESULTS AND IDENTIFY MITIGATION

The primary purpose of this section is to report the results of the various steps of the cumulative effect analysis. The 2010 Final EIS (Volume 7, Chapter 4: Cumulative Effects, Section 4.3.5: Cumulative Effect Assessment, pages 4-33 to 4-87) summarizes the results by resource with the following subsections:

- Current Health and Historical Context (Step 3 results)
- Direct and Indirect Impacts of the Preferred Alternative that might Contribute to a Cumulative Effect (Step 4 results)
- Reasonably Foreseeable Actions that Affect the Resource (Step 5 results)
- Potential Cumulative Effects (Step 6)
- Assess the Need for Mitigation (Step 8)

A similar format is used in this SEIS. However, the current health and historical context (Step 3) is updated with new information and instead of the preferred alternative all collective action alternatives are assessed.

Mitigation for DoD Projects

The DoD strives to avoid and minimize impacts during the initial alternatives evaluation and design phase of project development. BMPs, SOPs, and typical permit conditions are also implemented to mitigate impacts. BMPs are a type of mitigation measure but because they are SOPs for the DoD and not project-specific they are considered to be part of the proposed action. Potential project-specific mitigation measures are proposed in this SEIS (Tables 4.7-1 and 5.7-1) and include those resulting from ESA section 7 consultation and cultural resources review. Further, the 2011 PA provides a process for the mitigation of adverse effects to historic properties and impacts to other cultural resources.

The SEIS ROD would identify the mitigation measures that DoD commits to implementing. Mitigation measures can be classified as one of the following two types:

1. Within DoD control - DoD has statutory authority to implement actions taking place on lands under its control. DoD has limited statutory authority to implement natural and cultural resources mitigation measures on non-federal land.
2. Outside of DoD control - Except for the limited authority applicable to natural and cultural resources identified above, DoD does not have statutory authority to undertake mitigation measures on non-federal land.

Both types of mitigation serve to avoid, minimize, replace, or compensate for impacts if implemented by DoD or non-DoD agencies.

7.7.1 Geological and Soil Resources

Current Health and Historical Context. As summarized in Sections 3.1, 4.1.1.1, 4.2.1, 5.5.1 of this SEIS and in detail in the 2010 Final EIS (Volume 2, Chapter 3: Geological and Soil Resources, Section 3.1: Affected Environment, pages 3-1 to 3-30), Guam's geological and soil resources have been most affected by human populations in the past century. Of particular note, are impacts associated with WWII, during which time much of Guam's foliage was lost to bombings as the U.S. regained control of the island from Japan in 1944.

Subsequent to WWII, soil loss due to erosion is largely attributed to human-induced wildfires; construction and development with inadequate erosion control systems; recreation with off-road vehicles;

and introduced mammals. The occurrence of wildfires has increased over time. Between 1979 and 2001, over 99,000 acres (40,000 ha) of vegetation burned and Guam lost nearly a quarter of its total tree cover. The burn areas are often invaded by non-native grasses or become barren. The replacement of forest with savanna vegetation contributes to elevated soil loss, as erosion in savanna areas may be 100 times higher than in scrub forest. Popular use of off-road vehicles for recreation is also believed to be a major contributor to the development and persistence of erosion-prone cover types.

Construction often requires grading and filling, which may reduce soil quality that, in turn, may affect plant growth and runoff. Topography can be permanently altered in areas of steep slope. Vegetation removal can lead to loss of soils as windborne dust if not properly managed and/or controlled. Compaction also typically occurs at construction sites and can also increase erosion potential. Impervious surfaces (i.e., rooftops, sidewalks, roads, and parking lots) can accelerate water flows and lead to further soil loss and erosion if appropriate stormwater controls are not implemented. These are addressed in the water resource sections. Sinkholes are sensitive to both sediment input from grading activities and changes in hydrology.

Most recently, as in the case of the recently completed and present projects, the more stringent construction permit conditions and BMPs minimize the impact on the geological and soil resources. There is greater awareness of erosion control principles. Although there has been substantial degradation of the resource over time that may not be recoverable; the trend in the decline resource health has slowed. There may be occasional permit violations, but there are also revegetation and ungulate control programs that improve resource resiliency.

There are 21 recently completed projects identified with the potential to contribute to a cumulative effect to geological and soil resources on Guam (see Table 7.6-1), 10 beneficially and 11 adversely. Projects that could contribute to a beneficial impact include GovGuam Route 2 Culverts and Slide Repair (S-1) and Talofofo/Togcha Bridge Rehabilitation (S-2) because the projects may stabilize soils. In contrast, Amusement Park-Tumon (C-12) is a large project that will have a long term adverse impact on topography.

There are 25 present projects identified with the potential to contribute to a cumulative effect to geological and soil resources on Guam (see Table 7.6-1), 16 of which have a beneficial impact on this resource. Two beneficial projects are Agfayan Bridge Replacement (S-19) and Reforestation of Masso Reservoir (AH-2). Emerald Ocean View Park (C-21) would have long-term impact adverse impact on topography.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Tables 7.4-1 and 7.6-2 a significant impact on this resource would result under each of the collective action alternatives, except A-2, B-2, C-2, D-2, and E-2 that would have a less than significant impact. This significant impact is due to the long-term adverse topographic impacts associated with the grading required to develop the LFTRCs and the 2010 ROD-Related Actions. Less than significant impacts were identified for impacts on soils, sinkholes and geologic hazards for each of the collective action alternatives with the implementation of BMPs.

Reasonably Foreseeable Actions that Affect Geological and Soil Resources. There are two reasonably foreseeable projects identified with the potential to adversely impact topography including Sigua Highlands (C-47). Eight potentially beneficial projects include roadway improvement projects because they could reduce erosion associated with degraded pavement, such as Asan and Aguada Bridge Rehabilitation (AH-9).

Potential Cumulative Effects. Anticipated long-term impacts associated with collective action operations would not have an adverse cumulative effect when combined with the recently completed, present, and reasonably foreseeable actions on Guam identified above. Moreover, several activities and projects would have a beneficial impact on geology and soil resources both now and in the future. Uncontrolled human uses and natural events (e.g., typhoons, tropical storms, earthquakes, tsunamis) would continue to have an adverse impact on geological and soil resources. The significant impact identified for the collective action alternatives was related to topography. There are no thresholds established for the acceptable level for changes in topography. The magnitude of additive impact resulting from the collective action alternatives and recently completed, present, and reasonably foreseeable actions is considered to be low and would not appreciably impact the resiliency of geological resources on Guam over time (see Table 7.6-2).

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. No additional mitigation measures for cumulative effects are proposed.

7.7.2 Water Resources

Current Health and Historical Context. The historical context of surface water, groundwater, nearshore water, and wetlands on Guam is summarized in Sections 3.2, 4.2.2, 5.5.2, and in the 2010 Final EIS (Volume 7, Chapter 4: Cumulative Effects, Section 4.3.5.1: Guam Cumulative Effects Assessment, page 4-33). Soil erosion and stormwater runoff are largely responsible for degradation of surface and nearshore waters. As described above under Geological and Soil Resources, the introductions and increases of domesticated animals (water buffalo, pigs, goats, and deer) and farm crops likely denuded soils and contributed to erosion from vegetation loss and trampling. During WWII, much of Guam's foliage was lost to bombings. When the U.S. retook control of the island from Japan in 1944, tangantangan (native to the Americas) was planted to control erosion.

As described under Section 7.7.1, *Geological and Soil Resources,* wildfires and off-road vehicles contribute to soil erosion. The result is increased sedimentation/siltation of surface water. Eroded silt from these burn areas also destroys marine life in reefs around the island. In addition the loading of sediments in freshwater streams increases the turbidity in sources of drinking water, which can reduce the performance of treatment processes such as chlorine disinfection.

Once construction is complete, the addition of impervious surfaces (i.e., rooftops, sidewalks, roads, and parking lots) can accelerate water flows and lead to further soil loss and erosion if appropriate stormwater controls are not implemented. Past construction and development on Guam has resulted in the addition of approximately 12,280 acres (4,970 ha) of developed impervious surface area, representing approximately 1% of the island's total land area; there remains sufficient pervious surfaces for groundwater recharge.

Threats to surface water would continue to be monitored by federal and Guam agencies, and appropriate regulatory action would continue to occur to maximize surface water quality and availability. In time, with the implementation of stormwater BMPs during construction and operation, surface water resource impacts due to new projects would slow the decline of water quality. Monitoring and enforcement of permit conditions may be limited due to lack of funding but there is an increase in public awareness of the effects of erosion on water quality that could lead to greater reporting of permit violations. This would not correct the historical adverse impacts but could result in less of an impact due to future projects.

The nearshore water quality concerns for the marine waters of Guam include copper, aluminum, nickel, enterococci bacteria, total residual chlorine, biochemical oxygen demand, and total suspended solids. The non-point sources of these water quality concerns are difficult to address, but the planned improvements

to wastewater infrastructure, required upgrades of WWTPs treatment systems (as required by current NPDES permits), and the implementation of BMPs to address stormwater are expected to slow down the degradation of nearshore water quality due to man-made activities.

Threats to groundwater availability and quality (e.g., saltwater intrusion, leaky septic systems, and sewage spills) would continue to exist. A recently developed numerical groundwater model and an updated and expanded network of wells to monitor groundwater level and water quality would be used by the GWRDG to manage the NGLA. The improved management and monitoring of the NGLA and fewer septic systems in use (as anticipated in the future) are expected to ensure that a dependable and safe supply of groundwater would be maintained for Guam. In time, groundwater quality would be expected to slowly improve on Guam as point and non-point sources of pollution are identified, and pollution loading to surface waters is reduced, all within the framework of improved management and monitoring of the NGLA. In addition, the mission of the GWRDG (including DoD, GWA, GEPA, Consolidated Commission on Utilities, GDPW, and WERI) is to protect Guam's water supply for quantity, quality, reliability, sustainability, and availability for all of Guam - present and future.

Wetlands are impacted by soil erosion and physical removal and wetlands have been reduced or compromised overtime. These threats to wetland areas are monitored by federal and Guam agencies. Appropriate regulatory action would continue to occur to protect wetland areas. While the federal regulation focuses on a principle of no overall net loss to wetlands, there has been a historical loss of wetlands prior to regulatory control that would not be remedied. The non-point sources of pollution on Guam are not fully characterized and would continue to adversely impact wetlands. The implementation of BMPs described above for erosion control would reduce the rate at which wetlands degrade. In the future, it is anticipated that surface water, groundwater, nearshore and wetland quality would continue to decline, but the regulatory controls are expected to slow the rate of decline.

Fifty-two recently completed projects with the potential to contribute to a cumulative effect to water resources on Guam were identified (see Table 7.6-1). Nineteen of the projects would have a beneficial impact on water resources such as: Masso River Bridge Embankment (AH-3) and Togcha Bridge Rehabilitation (S-2), because they would potentially reduce erosion in surface waters. The new Dandan Landfill project (S-3) is heavily regulated and routinely monitored and stabilizes the badlands at the site. The adverse impacts associated with the projects are due to the increase in impervious surface and potential to impact stormwater. These varied projects include the Amusement Park (C-12) and residential development such as Hemlani Apartments (C-34). There is insufficient information on the projects to describe potential impacts to wetlands.

Ninety-six present projects with the potential to contribute to a cumulative effect on water resources on Guam were identified (see Table 7.6-1). Forty projects are potentially beneficial to water resources, because they are utility improvements or roadway improvements or rehabilitation projects that would likely minimize long-term sedimentation of surface water. These projects include: Deep Well Rehabilitation (G-17), Rehabilitation of Asan Springs (C-30), Reforestation of Masso Reservoir (AH-2), Hagåtña Sewage Treatment Plant (STP) Improvements (C-42), Northern District WWTP Phases 1-3 (N-32) and WWTP Priority 1 Upgrades (G-21). The new construction projects that would increase the amount of impervious surface could have an adverse impact, the largest of which include: Emerald Ocean View Park (C-21), and Sigua Highlands / near Leopalace (C-47). There is insufficient information on the projects to describe potential impacts to wetlands.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Tables 7.4-1 and 7.6-2 less than significant impacts to surface waters are anticipated for the NAVMAG LFTRC alternatives and no impact was identified for the others.

Short-term, localized significant-mitigable impacts to the affected basin within the NGLA but less than significant impacts to the overall NGLA were identified for all collective action alternatives due to long-term increase in annual groundwater production of 1.7 MGd (6.4 MLd) from the NGLA. This impact is the same for all collective action alternatives. This assessment assumes BMPs are effective at controlling soil erosion, pollutants of concern, and stormwater flow. The collective action alternatives would increase the impervious surface on Guam by approximately 176 acres (71 ha) for the cantonment/housing and LFTRC alone, representing an increase of approximately 1.4% of total development-related impervious surface area on the island. The 2010 ROD-Related Actions would result in additional impervious surface. Increases in impervious area would be managed through the implementation of an appropriate and comprehensive stormwater management plan utilizing a LID approach as described in Section 4.1.2.2 of this SEIS.

Groundwater production rates would slightly increase, and the implementation of sustainability practices would reduce the amount of groundwater needed per capita, which would help minimize impacts to groundwater availability. The resulting total annual groundwater production would be substantially less than the sustainable yield. Improved management and monitoring of the NGLA aquifer by the GWA and DoD would ensure increased pumping does not adversely affect sources of drinking water on Guam.

Significant and mitigable impacts were identified for all cantonment alternatives due to potential increases in the rate of sewage spills associated with the induced civilian growth and construction/DoD workforce would result in significant indirect impacts to groundwater quality. A potential mitigation measures includes DoD assisting GovGuam in identifying funding to upgrade the sewer lines.

Significant and mitigable impacts were identified for all cantonment alternatives due to an increase in wastewater discharge from the Northern District WWTP and for Alternative D also having an increase in wastewater discharge from the Agaña WWTP, which are both currently non-compliant with their current NPDES permits. Potential mitigation measures includes DoD assisting GovGuam in upgrading the Northern District WWTP treatment systems (as required by current NPDES permits) and in identifying additional sources of funding to construct treatment facility improvements at the Agaña WWTP. Once the WWTPs are in compliance, the long-term nearshore water quality is expected to improve.

Significant mitigable impact on wetlands would result with the three collective action alternatives that propose LFTRCs at NAVMAG. Specifically, the alternatives are: A-2, A-3, A-4; B-2, B-3, B-4; C-2, C-3, C-4; D-2, D-3, D-4; and E-2, E-3, E-4. In addition, the cantonment alternative at Barrigada could have a long-term indirect impact to approximately 0.1 acre (0.04 ha) of wetlands. The wetland impacts at NAVMAG range from 17.7 acres (7 ha) for the East/West LFTRC to 36.9 acres (15 ha) for the North/South LFTRC. No wetlands were identified for the 2010 ROD-Related Actions and the additive impacts of Section 6.1. The collective action alternatives that include Barrigada for cantonment and NAVMAG for LFTRC (i.e., D-2, D-3, D-4) would have a slightly greater impact on wetlands than the other collective action alternatives. Potential mitigation measures would be developed during the Section 404 permit application review.

Reasonably Foreseeable Actions that Affect Water Resources. Fifteen reasonably foreseeable projects are anticipated to contribute to a cumulative effect on water resources on Guam (see Table 7.6-1). Ten of the projects are presumably beneficial because they are roadway rehabilitation projects that improve pavement integrity resulting in less erosion potential, such as: Route 10A, Rehabilitation & Widening,

Sunset Blvd. to Route 16 (C-37), Asan and Aguada Bridge Rehabilitation (AH-9). The remaining projects include development of various sizes throughout the island that would contribute to an increase in impervious surface, such as Guam Regional Medical City (N-38). Additionally, development projects are likely to increase the demand on Guam's groundwater resources, particularly the NGLA.

Potential Cumulative Effects. Recently completed, present, and reasonably foreseeable future projects would involve construction activities that would result in the potential for a temporary increase in stormwater runoff, erosion, and sedimentation. For projects disturbing more than 1 acre (0.4 ha) during construction (including the collective action alternatives), a Construction General Permit would be obtained and followed, and a SWPPP would be prepared and implemented to minimize temporary increases in runoff and pollutant loading related to construction activities. There is an existing DPRI Construction Program final Comprehensive SWPPP for the 2010 ROD-Related Actions that are included in the collective action impacts.

In addition, recently completed, present, and reasonably foreseeable future projects would result in an increase in impervious surface area in urban and industrial settings, resulting in a corresponding increase in stormwater runoff that has the potential to have elevated levels of contaminants, such as sediments, nutrients, heavy metals, organic and inorganic compounds, and detrimental microorganisms in water resources. Many of these projects especially, if they are new construction, are likely to increase the impervious surfaces that would result in an associated increase in stormwater discharge intensities and volume. New projects are subject to GovGuam review which includes a review of drainage and stormwater control.

In addition, cumulative actions would be expected to increase the amount of POLs, hazardous waste, pesticides, and fertilizers being stored, transported, and utilized. Increasing the storage, transportation, and use of these substances would increase the potential for releases to water resources. Implementation of BMPs associated with addressing site- and activity-specific water resource protection needs, provisions of facility-specific SWPPPs, and SPCC Plans would minimize potential impacts from facility operations, to include the transportation, storage, and use of fuel, on all water resources. In addition, adherence to surface water quality and volume control measures would also reduce pollutant loading to groundwater basins, nearshore waters, and wetlands. Many of the projects could potentially impact water resources. The cantonment/family housing and LFTRC would increase the total existing development-related impervious surface area on Guam by approximately 1.4%; however, the implementation of BMPs and LID measures would ensure no off-site transport of excess stormwater runoff. The additive effect of the collective action in conjunction with the cumulative actions is expected to be low.

Recently completed, present, and reasonably foreseeable future projects include connections to wastewater collection, treatment, and disposal systems. Short-term, direct impacts from increased wastewater discharge from the Northern District WWTP would be non-compliant with the 2013 NPDES permit that requires treatment system upgrades. There are a large number of projects, including other DoD projects, in the northern part of Guam. Four of the five cantonment alternatives also are proposed in the northern part of Guam. There is potential for a strong cumulative impact on nearshore water quality associated with increased service loads at the Northern District WWTP, which is not in compliance with NPDES permit requirements. Once upgrades to address the permit conditions have been completed there would be an improvement to nearshore water quality. This cumulative effect to nearshore water is not expected for other geographic areas of Guam.

Projects that would reduce and/or ensure less reliance on septic systems for wastewater disposal; thereby resulting in a benefit to groundwater resources. Furthermore, identified sustainability measures associated

with the collective action alternatives (e.g., conserving water), when combined with similar measures for applicable cumulative actions, would benefit groundwater resources. These measures would also benefit nearshore waters by reducing the nutrient and bacteria load. The collective action would not have a cumulative effect on these beneficial impacts, except as described for the Northern District WWTP improvements as described in the previous paragraph.

Average daily groundwater production rates are estimated to increase due to the collective action by 1.7 MGd (6.4 MLd). In addition to potable water demand generated under Alternative A, organic civilian population growth independent of the proposed action is estimated to result in an average daily long-term increase in water demand of 3.5 MGd (13.2 MLd). The demand from organic civilian growth would be satisfied by the GWA system, primarily from the NGLA, but also from surface water in southern Guam. The forecast water demand increases steadily through year 2028 due to the impact of induced and organic civilian growth. Total average daily water extraction from the NGLA from all sources (DoD water system, GWA water system, and a few private wells) is estimated to be 47.0 MGd (177.9 MLd) in year 2028 but would be less than the sustainable yield of 80.5 MGd (304.7 MLd). Management of the NGLA would be improved through the use of the numerical groundwater model and an updated and expanded network of monitoring wells. The magnitude of the additive cumulative effect of the collective action on ground water in conjunction with the cumulative actions is strong.

2010 ROD-Related Actions and non-DoD projects involving construction in Apra Harbor would have the potential for cumulative effects to nearshore waters. However, these projects would require Section 404(b) and Section 10 of the Rivers and Harbors Act permits from the USACE, and Water Quality Certification from the GEPA. Permit conditions mitigate the impacts on surface water. The additive effect would be low in magnitude.

There is the potential for the recently completed, present, and reasonably foreseeable future projects to have direct and indirect impacts to wetland areas possibly resulting in the loss of wetland area and/or function. The collective action alternatives that include NAVMAG LFTRCs would impact wetlands. Per USACE regulations, activities that are proposed in wetlands or that could potentially reduce wetland area or function must be permitted and potentially mitigated to compensate for impacts to wetland areas. Therefore, any loss of wetland area or functionality would be potentially mitigated at a project and site-specific ratio, which would likely include creating or enhancing existing wetland habitat elsewhere on Guam. Indirect impacts to wetland areas (e.g., runoff, sediment loading) would be addressed on a project-specific level, and would likely be lessened with BMPs and associated short- and long-term stormwater runoff management measures. There is insufficient information on the recently completed, present, and reasonably foreseeable future projects to assess the potential for cumulative effect on wetlands; however, the assumption is GovGuam agencies would not approve projects that have a direct impact on wetlands. While the collective action may have a significant mitigable impact on wetlands, the additive effect is considered low in magnitude.

In summary, implementation of the collective action alternatives, when considered in conjunction with specific projects on Guam, would have a cumulative effect on water resources. The additive effect of each collective action alternative would be strong (see Table 7.6-2) specifically as it relates to the nearshore waters of northern Guam and the Northern District WWTP and groundwater.

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. GovGuam reviews private and commercial development proposals for potential impacts to water resources. There are ongoing local and federal conservation and

restoration efforts to improve water quality. No additional mitigation measures for cumulative effects are proposed.

7.7.3 Air Quality

Current Health and Historical Context. Guam's air quality is described in detail in the 2010 Final EIS (Volume 2, Chapter 5: Air Quality, Section 5.1: Affected Environment, pages 5-1 to 5-14). There are no comprehensive ambient background air quality levels from recent monitoring available for Guam. Guam's existing background air quality conditions can be defined based on the current ambient air quality attainment status applicable to Guam, which is:

- Attainment for all criteria pollutants except SO_2.
- Two SO_2 nonattainment areas within a 2.1-mile (3.5-km) radius around Piti and Tanguisson power plants.

Except for power generating facilities, there are no significant stationary sources of air emissions on Guam. It can be assumed that prior to the non-attainment designation in the 1970s; historical ambient air quality was good before and after WWII.

Four recently completed projects were identified with the potential to contribute to a cumulative effect to air quality (see Table 7.6-1). Three projects with potential adverse impacts, including Route 8/10/16 Tri-intersection (C-16), could contribute to the exhaust from idling vehicles. The Ungulate Fencing project (N-24) is likely to have a beneficial impact by promoting the growth of more vegetation to absorb air quality particles.

Eight present projects with the potential to contribute to a cumulative effect to air quality on Guam were identified (see Table 7.6-1). The wind turbines (C-32) are expected to have a beneficial impact by offsetting the increased use of fossil fuels for power generation, while the Pacific Airpower Resiliency (N-26) is likely to have an adverse impact due to an increase in air traffic and use of fossil fuels.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. The collective action alternatives would result in less than significant and mitigable impacts to Guam's air quality, as summarized in Table 7.4-1 and 7.6-2. Operational air emissions originate from stationary and mobile sources. The basis of the air impact analysis was a significance criterion of 250 tons per year for air pollutants. Air emissions associated with both construction and operation of the collective action alternatives would be well below the significance criteria of 250 tons per year for all air pollutants. It is the on and off-base vehicle traffic that could exceed the 250 tons per year threshold of significance for CO. These impacts, however, would be temporary and localized at intersections. Construction and operational phase off-base roadway hot spot particulate matter, carbon monoxide, and mobile source air toxics impact conclusion will be provided after the analysis is completed. The cantonment/family housing and LFTRC pairings, the additive impacts of Section 6.1 and 2010 ROD-Related Actions would all contribute to the less than significant impacts of the collective action alternatives.

Reasonably Foreseeable Actions that Affect Air Quality. One reasonably foreseeable project is anticipated to contribute to a cumulative effect to air quality on Guam (see Table 7.6-1). The 60 MW Power Plant (G-6) is the project likely to have an adverse impact because of increased fossil fuel use and expanded flight capacity.

The future traffic growth would likely result in an increase in mobile source emissions on Guam. However, the reduction of mobile source engine emissions in the future, per CAA requirements, would contribute to a reduction of the overall mobile source and greenhouse gas emissions. Therefore, the air

quality conditions affected by mobile source operations would likely remain the same or improve slightly, as compared to the existing conditions.

Potential Cumulative Effects. Current projects on Guam consist primarily of building developments, infrastructure upgrades and improvements, and military projects that would contribute to man-made air emissions. Activities that increase emissions in the non-attainment areas are likely to have a greater cumulative effect. However, there are projects that are expected to reduce air emissions, such as the port improvements. The GEPA has adopted the USEPA-established stationary source regulations discussed previously, and acts as the administrator to enforce stationary source air pollution control regulations on Guam. Current air quality regulations are applied to air emissions from new sources for the protection of human health. The recently completed, present, and reasonably foreseeable future projects would not necessarily result in increases in island-wide traffic and air emissions, but new destinations would shift the emissions from mobile sources.

There will be cumulative effects associated with the collective action alternatives and the actions of other federal agencies, local governments, and the private sector on air quality on Guam. The degree of additive impact resulting from the collective action alternatives is considered to be low, in part because the collective action alternatives are not located in the non-attainment area and would not exceed air quality thresholds. The cumulative effect would not appreciably impact the quality of the ambient air over time (see Table 7.6-2).

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. No additional mitigation measures for cumulative effects are proposed.

7.7.4 Noise

Current Health and Historical Context. Guam's noise environment is discussed in detail in the 2010 Final EIS (Volume 2, Chapter 6: Noise, Section 6.1: Affected Environment, pages 6-1 to 6-20). WWII bombings and air operations may represent the loudest period on Guam's history; however, those noise impacts were not long-term. Existing sources that contribute to ambient noise include the commercial airport, AAFB airfield, industrial facilities, military training range activities, and traffic. Most of these noise impacts are intermittent. Industrial noise, such as power generation, would emit noise for longer periods, but is subject to OSHA regulations to protect the hearing of sensitive receptors, specifically workers. There is no island-wide noise level monitoring, and trends in noise are not documented island-wide. The cumulative effects would be geographically limited.

Two recently completed actions with the potential to contribute to cumulative effects on noise on Guam were identified (see Table 7.6-1): MIRC (G-2) and Naval Hospital Replacement (C-8), both of which would involve air traffic that generates noise. They are not in the same geographic location.

Four present projects with the potential to contribute to a cumulative effect to ambient noise on Guam are located at AAFB, including the PRTC RH Airfield Operations (N-49).

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Tables 7.4-1 and 7.6-2, there would be a significant mitigable impact on ambient noise due to the LFTRC at Route 15 that is a component of the following collective action alternatives: A-1, B-1, C-1, D-1, and E-1. Civilian residences were identified within the Zone 2 noise contour. Potential mitigation measures are summarized in Table 5.7-1. All other collective action alternatives would have a less than significant impact on noise due to cantonment traffic, 2010 ROD-Related Actions (i.e., airfield operations).

Reasonably Foreseeable Actions that Affect Noise. One reasonably foreseeable future project involving air operations that is anticipated to contribute an adverse noise impact on Guam (see Table 7.6-1) is Guam Airport Projects (C-35). The adverse impact is based on presumption that the improvements could facilitate more air traffic-related noise.

Potential Cumulative Effects. Operations of all the recently completed, present, and reasonably foreseeable future projects would generate some level of noise, but none are likely to exceed federal or local noise level thresholds for compatible land uses beyond the property boundary. Military mission changes, changes to commercial air traffic and increases in roadway traffic would likely have the most impact on ambient noise levels. Cumulative effects would result when these localized impacts overlap and impact the same sensitive receptors.

The significant mitigable noise impacts associated with the LFTRC at Route 15 would be in the vicinity of Guam International Raceway, which also generates noise. There would be no cumulative effect because the collective action alternative precludes the operation of the raceway. Besides traffic and quarry operations (N-17), no other significant noise generators were identified in the vicinity that could contribute to a cumulative effect. Cumulative noise effects were not identified in the geographic area of the NAVMAG LFTRCs.

The air combat element of the 2010 ROD-Related Action would contribute to the noise generated from other recently completed, present, and reasonably foreseeable actions at the AAFB airfield. However, no additive impact was identified on the civilian community outside of the installation. The existing noise contour that encumbers the community would not expand.

There would be noise impacts associated with the NWF LFTRC collective action alternatives and there are ongoing training activities at NWF that contribute to the noise levels in the vicinity. However, no additive impact was identified on the private residences outside of AAFB. An additive noise impact on terrestrial biological resources was identified, as described in Section 7.7.8.

There would be impacts associated with the collective action alternatives and the actions of other federal agencies, local governments, and the private sector on ambient noise on Guam; however, the effects would not be concentrated in one geographic area. The collective action alternatives would have a low additive cumulative effect, because the affected areas are geographically limited and the impacts are reversible when operations cease (see Table 7.6-2).

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. No additional mitigation measures for cumulative effects are proposed.

7.7.5 Airspace

Current Health and Historical Context. As summarized in Sections 3.5, 4.2.5, 5.5.5, and in the 2010 Final EIS (Volume 7, Chapter 4: Cumulative Effects, Section 4.3.5.1: Guam Cumulative Effects Assessment, page 4-40), SUA is designed to alert users about areas of military activity, unusual flight hazards, or national security needs, and to segregate that activity from other airspace users to enhance safety. The commercial air traffic fluctuates based on tourism levels, and military use at AAFB is mission-dependent. Training activities are addressed in the MIRC Airspace Environmental Assessment/Overseas Environmental Assessment and MITT EIS/OEIS (discussed in Section 7.5). Construction activities rarely impact airspace, but airspace may be impacted by operations on the ground. Because there are multiple, and sometimes competing, demands, the FAA considers all aviation airspace requirements in relation to airport operations, federal airways, jet routes, military flight training activities, and other special needs to

determine how the National Airspace System can best be structured to satisfy all user requirements. Significant impacts are avoided prior to FAA approval. While there is a trend toward an increase in air traffic or ground-based activity that may potentially impact air navigation, significant impacts are avoided through regulatory oversight. Since the 2010 Final EIS, there have been no substantive changes to the quantity and quality of airspace Guam-wide and there have been no substantive changes to laws, regulations or policies relative to airspace.

There are two recently completed projects that have the potential to contribute to a cumulative effect to airspace on Guam: Naval Hospital Replacement (C-8), because there is a helicopter landing site and Air Freight Terminal Complex (N-23), because it could represent an increase in air traffic (see Table 7.6-1). However, the existing SUAs described in the affected environment sections of this SEIS represent the cumulative effects on airspace to date.

Eight present projects have potential to contribute to a cumulative effect. Two of these are wind turbine projects (S-4 and C-32) that would likely be subject to FAA approval prior to construction, if they were to occur near a runway, to ensure there was no air navigation hazard. No cumulative effect would be associated with these projects. Pacific Air Power Resiliency (N-26), MIRC Airspace (G-3), MITT (G-23) and Terminal High Altitude Area Defense (N-39) would impact military air traffic. As these projects are reviewed by FAA, they are incorporated into the airspace existing condition.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. All of the collective action alternatives have potential to result in a significant mitigable direct impact on airspace. The impact on commercial air traffic is distinct from military air traffic. Significant mitigable impacts on civilian air traffic were identified for collective action alternatives, except those that included NWF LFTRC (see Tables 7.4-1 and 7.6-2). The NWF LFTRC collective action alternatives (i.e., A-5, B-5, C-5, D-5, and E-5) would have a less than significant impact on civilian air traffic because they would be located a greater distance from the Guam International Airport airspace. These collective action alternatives affecting NWF would have a significant mitigable impact on military air traffic, while the other alternatives would have no impact on military air traffic.

The cantonment/family housing component of the collective action alternative would have would have no impact on airspace. There would be an increase in the total aircraft under the 2010 ROD-Related Actions, but the existing SUA would be used.

Reasonably Foreseeable Actions that Affect Airspace. There is one reasonably foreseeable project that could potentially contribute to a cumulative airspace impact on Guam, Guam Airport Project (C-35), because airport improvements could increase the air traffic capability or require changes to airspace (see Table 7.6-1).

Potential Cumulative Effects. FAA manages the cumulative effect of air traffic and SUA to ensure there are no significant impacts to airspace. There is a potential additive impact between the collective action alternatives and the recently completed, present, and reasonably foreseeable future projects, resulting in modifications to and additional SUAs over time. The degree of additive adverse impact on air traffic resulting from the collective action alternatives is considered to be low, primarily due to FAA regulatory control (see Table 7.6-2). The effects would be reversible if air traffic is reduced and live-fire training stopped.

Need for Mitigation. As summarized in Table 7.6-2, the military and civilian air traffic significant impacts would be further studied through the DON/FAA consultation process and measures would be identified through this consultation process to minimize the potential impacts associated with the proposed action.

The FAA consultation process is applicable to recently completed, present and future projects. No additional mitigation is warranted.

7.7.6 Land and Submerged Land Use

Current Health and Historical Context. In the 1950s, Guam land use zoning was adopted to manage non-federally controlled land development. Submerged lands ownership has not changed substantially since 1975. As lands were released through BRAC, adjacent submerged lands were not released. There have and will continue to be zoning variances, conditional use permits, and changes to the zoning map. Historically, these were granted excessively, without consistent long range planning. The recent past, current and future trend is for increased management of land use to be consistent with community and master plans; however, it is difficult to correct historical zoning decisions. The development that is inconsistent with zoning is occurring at a less rapid rate. Public access restrictions to federal land and submerged lands have historically been and continue to be a land use issue. The amount of federal land has decreased substantially since WWII.

Access to fishing areas and other recreational areas has declined over time due to designated military training areas and the GovGuam designation of Marine Protected Areas, as shown on Figure 3.6.1-1. The restricted areas are spread out along Guam's coast and offshore waters. The training events and tempo are not continuous and notice to mariners is provided in advance of the training event. The prime fishing areas are not contiguous. Favorable ocean conditions suitable for fishing or other recreation activities are not constant or predictable and also contribute to submerged lands inaccessibility. There are some areas such as the northern and eastern submerged lands that tend to be rough water most of the year, which increases the demand for submerged land access to western and southern submerged lands. Homeland Security guidelines include maintaining a minimum of 100-yards (91 m) distance from and maintaining minimal speed within 500 yards (457 m) of a U.S. naval vessel. The recreational vessels must detour around naval traffic. All of these factors contribute to the cumulative limitations of public access to prime fishing/recreational submerged land areas.

There are fish aggregating devices and shallow water moorings that facilitate access to submerged lands for recreational use; however, they require maintenance pending available funding and some are no longer useable. Access to the offshore fishing areas on the eastern and northern Guam coast is limited by minimal wharf/pier infrastructure and generally unfavorable ocean conditions. Although there are no regulatory thresholds for measuring these types of land use impacts, the public access to submerged lands is likely to continue to be constrained by natural and anthropogenic factors

Six recently completed projects with the potential to contribute to a cumulative effect to land and submerged land use on Guam were identified (see Table 7.6-1) and two of these could be beneficial, including Upgrade of Existing 14 Megavolt Ampere Power Transformer to 30 Megavolt Ampere and Underground Line (G-5) and Release a Guam Land Use Plan 77 Parcel Near South Finegayan (N-15). The former minimizes land use restrictions by undergrounding a utility line and the latter reduces federal land. Large development projects have potential to adversely impact adjacent land uses, including Amusement Park-Tumon (C-12). The MIRC EIS (G-2) proposed increases in training tempos on various ranges on and around Guam that potentially adversely impact public access to submerged lands.

Nine present projects with the potential to contribute to a cumulative effect to land and submerged land use on Guam were identified (see Table 7.6-2) and five are potentially adverse, including UOG Wind Turbine (C-32); 15 MW GovGuam Solar/Wind Turbine (S-4); Guam Regional Medical City (N-38) and MITT (G-23). Wind turbines and large medical facilities may have land use siting/compatibility issues. Lateral Conversion of Power Lines to Underground Lines (G-11) could have a beneficial impact on land

use. MITT would have an adverse impact on submerged land public access to recreational activities, including fishing.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. All collective action alternatives would result in significant impacts to land or submerged land use, except collective action alternatives involving the NAVMAG North/South LFTRC (i.e., A-3, B-3, C-3 and D-3), which were described as having less than significant impacts on land use. The significant impacts are due to new or an increased level of restrictions on public access to areas that are important to the community. Primarily, the impact is related to LFTRC land acquisition and the encumbrance of submerged lands by the SDZs, both of which restrict public access.

The collective action alternatives that include the Route 15 LFTRC (i.e., A-1, B-1, C-1, D-1, and E-1) have additional impacts associated with incompatibility with existing and future residential land uses that contribute to the significant impact, such as the closure of Guam International Raceway and residential uses within the noise Zone 2 and 3 contours.

The NAVMAG East/West and NAVMAG L-Shaped LFTRC (Alternative 2 and 4, respectively) would potentially impact the use of the Bolanos Conservation Area.

The 2010 ROD-Related Actions (Section 6.2) and the additive impacts (Section 6.1) do not contribute to the level of land/submerged land impacts.

Reasonably Foreseeable Actions that Affect Land and Submerged Land Use. Two reasonably foreseeable future projects are anticipated to contribute to a cumulative effect to land and submerged land use on Guam (see Table 7.6-1). For example, GovGuam proposes a prison (G-10) and a new 60 MW power plant (G-6) that may have siting/land use compatibility issues.

Potential Cumulative Effects. The military training projects would continue to the current level of or increase the public access restriction to submerged lands during training events. The proposed collective action alternatives with LFTRC SDZs that extend into submerged lands, including the preferred alternative, would have a significant impact on submerged land use. GovGuam review of projects would ensure that the non-DoD projects are compatible with existing and future land uses.

Public access to submerged lands for fishing and other recreational activities has declined over time due to a variety of natural and anthropogenic factors. The additive impact of the proposed collective action alternatives (those with LFTRC SDZs in submerged lands) in conjunction with the declining "health" of submerged land public access would result in a cumulative moderate magnitude of adverse impact. The impact is reversible with changes in military training tempo and decreased submerged land regulation; however, there are no plans to reduce these restrictions. There will always be uncontrollable natural conditions such as stormwater runoff and unfavorable weather that would also contribute to reduced public access to submerged lands.

Need for Mitigation. DoD would work with GDAWR and the GFCA in their ongoing efforts to install and maintain fish aggregating devices and shallow water moorings to improve submerged land access for private and military use. Other potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1.

7.7.7 Recreational Resources

Current Health and Historical Context. Sections 3.7, 4.2.7, 5.5.7, and in detail in the 2010 Final EIS (Volumes 2, 4, and 5, Section 9.2; Volume 6, Section 11.2), summarize the historical context of recreational resource uses. The boom in the tourist industry in the early 1990s likely resulted in an

increase in conflicts among recreational users and physical deterioration of resources. Other human and natural factors, such as typhoons, coral bleaching, illegal harvesting of coral and fish, non-point source pollution, and insufficient funding for resource management, would continue to adversely impact recreational resources.

Nine recently completed projects with the potential to contribute to a cumulative effect to recreational resources on Guam were identified (see Table 7.6-1). Seven projects could add to the potential number of recreational users and thus have the potential to adversely impact, including Workforce Housing (N-10) and a new hotel (C-4), Talo Verde Estates (C-2), and Hemlani Apartments (C-34). Two projects could have a beneficial impact because they add diversity and/or create recreational opportunities. This includes the recent completion of the Amusement Park in Tumon by Tagada Guam (C-12) and the new GovGuam Student Center (C-13).

Sixteen present projects have the potential to contribute to a cumulative effect to recreational resources on Guam (see Table 7.6-1). Five projects could have a beneficial impact to recreational resources by adding to the diversity and quantity of options for recreation, such as swimming pools, tennis, and/or golf. Gregorio D. Perez Marina Renovation & Site Improvement Project (C-39) and Gregorio D. Perez Marina Dock C Repairs (C-40) would improve the marinas used by recreational boaters. However, the majority of projects could adversely impact recreational resources because they could increase the resident population. Projects that increase housing and accommodations (C-21), and new residential style housing (N-36) could create more individuals seeking leisure and recreational activities.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Tables 7.4-1 and 7.6-2, the impact on recreational resources would be significant for all of the collective action alternatives. Within the vicinity of the proposed NWF LFTRC (Alternative 5), there are a number of recreational opportunities, including beaches, picnic sites, camping areas, water sport sites, fishing and game sports, nature activities, scenic drives and overlooks, interpretive centers and parks, particularly the Guam NWR. The SDZs for the LFTRC extend over many of the aforementioned ocean and shoreline recreational resources. Operations would impact 147 acres (57 ha) of the Ritidian Point Unit of the Guam NWR and 240 acres (97 ha) of beachfront may be restricted during training exercises as described in Section 5.5.7.2. Access to much of this area is already restricted for natural resources conservation purposes.

The Guam International Raceway would be precluded by the collective action alternatives involving the LFTRC at Route 15 resulting in the loss of a valued recreational resource. The NAVMAG LFTRCs would have significant impacts on the ambient noise levels at recreational resources in the vicinity.

The cantonment components, 2010 ROD-Related Actions (Section 6.2) and the additive actions (Section 6.2) would have less than significant impacts on recreational resources due to an anticipated increase in use of recreational facilities throughout Guam than impacts to specific recreational resources.

Reasonably Foreseeable Actions that Affect Recreational Resources. One reasonably foreseeable project has the potential to contribute to a cumulative effect to recreational resources on Guam, Sigua Highlands (C-47) because the project is growth inducing for that area (see Table 7.6-1).

Potential Cumulative Effects. Several of the listed projects appear to have a recreational component that would create new recreational opportunities or increase capacity. The collective action alternative would have an additive cumulative impact on recreational resources in conjunction with increased tourism and other DOD mission changes because they would increase the on-island population. Increases in recreational resources use would likely occur at beaches and parks, scenic points, historic and cultural

sites, dive spots, trails, day use resorts, golf courses, sailing venues, on installations, and the rest of the island alike. Guam's tropical weather encourages year-round use of recreational resources by residents and visitors. Foreseeable impacts include inadequate or overly crowded facilities such as parking, picnic shelters, restrooms, showers, and boat mooring facilities. Moreover, an eroded sense of enjoyment, due to increased competition for opportunities among users, would result at most recreational facilities (e.g., golf courses on installations, and popular dive spots). Lastly, an increase in the number of users could accelerate deterioration of existing facilities.

There will be cumulative effects associated with the collective action alternatives and the actions of other federal agencies, local governments, and the private sector on recreational resources on Guam. The magnitude of the effect is moderate (see Table 7.6-2) because there may be thresholds of recreational resource health but they are for specific recreational sites or activities. The pressure on recreational resources could be adaptively managed. Long-term impacts could be reversed if there are appropriate resources.

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. No additional mitigation measures for cumulative effects are proposed.

7.7.8 Terrestrial Biological Resources

Current Health and Historical Context. As summarized in Chapters 3, 4, and 5 of this SEIS, and in detail in the 2010 Final EIS, the terrestrial biological health on Guam is declining. The effect of pre-colonial activities on the current health of Guam's terrestrial biological resources is unknown. During the Spanish Period (1668-1899) there were introductions and an increase of domesticated animals (i.e., water buffalo, pigs, goats, and deer). Introduced ungulates have significantly impacted native forests by consuming seeds, fruits and foliage and trampling plants. Feral pigs also cause additional damage by wallowing and rooting.

WWII physically destroyed extensive areas of habitat (due to war actions and construction) along with continued clearings associated with agriculture (i.e., crops and grazing). Shortly after WWII, the brown treesnake was inadvertently introduced to the island and by the late 1960s had spread throughout Guam (Section 1.3.3).

Existing stressors (e.g., tropical storms, typhoons, invasive species, diseases, wildfires, development, and poaching) continue to degrade habitat quality, population resiliency, and contribute to the trend of declining health of terrestrial biological resources. Ongoing efforts to manage terrestrial resources on military lands and non-federally controlled lands would continue to reduce the rate of decline.

Fewer than 1,000 threatened Mariana fruit bats were believed to occur on Guam in 1972 and less than 100 bats from 1974 to 1977. The most recent surveys suggest that fewer than 50 bats remain on Guam. Hunting pressure is largely responsible for the decline. Although hunting is illegal, it remains a threat.

The endangered Guam rail and Guam Micronesian kingfisher are believed to have been extirpated in the wild by 1985 and 1988, respectively. Both species were close to becoming extinct along with the majority of Guam's other avifauna as a direct result of predation by the introduced brown treesnake. The Guam rail exists primarily in captivity on Guam and in mainland zoos. Guam rails were introduced onto Rota, CNMI in 1989 and onto Cocos Island, off the southern coast of Guam, in 2011. The Guam Micronesian kingfisher is now found only in captivity on Guam and at mainland zoos. Research and management efforts continue so that wild populations of Guam rails and Guam Micronesian kingfishers may eventually be reestablished on Guam.

Historically on Guam, the endangered Mariana crow was found throughout forested areas, and was considered common into the early 1960s. As of 2012, the Mariana crow is considered extirpated in the wild on Guam. The closest population of crows is on the island of Rota, north of Guam. Predation by brown treesnakes, rats, and monitor lizards prevents recovery.

Fifty-eight recently completed projects have the potential to contribute to adverse cumulative effect to terrestrial biological resources on Guam (see Table 7.6-1). The primary impact from these projects would be the potential loss of native habitat and the increased potential for the spread of invasive species. One project may have a beneficial impact, Ungulate Fencing (N-24).

Sixty-seven present projects have the potential to contribute to an adverse cumulative effect to terrestrial biological resources on Guam (see Table 7.6-1). This would be primarily due to the potential loss of native habitat and the increased potential for the spread of invasive species. Reforestation of Masso Reservoir (AH-2) could have a beneficial impact on terrestrial biology.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Tables 7.4-1 and 7.6-2, the impact on terrestrial biological resources would be significant and mitigable for all of the collective action alternatives. All five resource areas assessed (e.g., vegetation, terrestrial conservation areas, native wildlife, federal special-status species, Guam special-status species) would be significantly impacted by the direct and indirect impacts of the LFTRC and cantonment pairings, except there would be a less than significant impact on native vegetation for all pairings. The adverse impacts would occur during construction and operations phases. Significant potentially mitigable impacts were also identified for the 2010 ROD-Related Actions (Section 6.2). The additive impact associated with the proposed IT/COMM infrastructure was determined to be less than significant (Section 6.1).

All collective action alternatives convert limestone forest to developed area and the greatest acreage affected is associated with the cantonment components and 2010 ROD-Related Actions. Overlay refuge areas would be adversely affected under all collective action alternatives. Federal special-status species that would be impacted include the Mariana fruit bat, Mariana crow, Guam Micronesian kingfisher, the Guam rail and the *Serianthes* tree. The impact on individual species varies among the collective action alternatives.

Reasonably Foreseeable Actions that Affect Terrestrial Biological Resources. Fifteen reasonably foreseeable projects have the potential to contribute to an adverse cumulative effect to terrestrial biological resources on Guam (Table 7.6-1). This would be primarily due to the potential loss of native habitat and the increased potential for the spread of invasive species. Examples of projects with potential adverse impacts include Sigua Highlands (C-47), Route 4 Curve Widening (S-28), and 60 MW power Plant (G-6).

Potential Cumulative Effects. All new development requiring vegetation clearing has potential to impact terrestrial biological resources. There are federally and locally established habitat conservation areas and increases in human population or other noise generating activities near these areas can disturb the populations of species that are to be protected in the conservation areas.

There would be cumulative effects associated with the collective action alternatives in conjunction with recently completed, present, and reasonably foreseeable actions. The additive impact of would be strong (see Table 7.6-2) because the impacts could be long-term and difficult to reverse. Many of these projects, developments, and actions, and their impacts on terrestrial biological resources cannot be determined with specificity at this time. Most of the projects require ground disturbance, and the assumption is that

terrestrial biological resources would be affected. The terrestrial biological resource health on Guam would continue to decline, and threatened and endangered species would continue to be vulnerable to natural and anthropogenic stressors. Because the development area of the collective action alternatives is presumably larger than that of the recently completed, present, and reasonably foreseeable actions, the additive cumulative impacts are primarily due to the direct impacts of the collective action alternatives.

Need for Mitigation. Potential mitigation measures for the impacts due to the collective action alternatives are proposed in Tables 4.7-1 and 5.7-1. GovGuam reviews public, private, and commercial development proposals for potential impacts to terrestrial biological resources. The USFWS monitors GovGuam, private, and commercial development proposals and periodically adjusts the acreage of available recovery habitat island-wide. This adjustment is used to determine the impact of federal development proposals that must comply with section 7 of the ESA and may result in mitigation for federal development proposals. The USFWS and GovGuam review DoD and other federal development proposals and mitigation is developed through the consultation process. There are local and federal initiatives and protocols to prevent the introduction of non-native species. There are local and federal conservation and restoration efforts. No additional mitigation is proposed for cumulative effects to terrestrial biological resources.

As part of the ESA section 7 consultation process, the DON and the USFWS entered into an MOA, which would, if the preferred alternative is chosen, facilitate kingfisher conservation goals. In the MOA, the DON agreed to designate approximately 5,234 acres (2,118 ha) under the custody and control of the DoD in northern Guam to a status that will provide durable habitat protection needed to support native habitat restoration and land management for the survival and recovery of the kingfisher. Consistent with the JRM INRMP developed in accordance with Section 101 of the Sikes Act, the DON agreed to actively restore native habitat and manage, in collaboration with the USFWS, the 5,234 acres (2,118 ha) consistent with DoD's obligations under ESA section 7(a) and the Sikes Act to benefit the survival and recovery of the kingfisher. The DON would work cooperatively with the USFWS to identify, develop and implement specific management activities and projects on these 5,234 acres (2,118 ha) to support the reintroduction and recovery of the kingfisher.

These 5,234 acres (2,118 ha) have been identified by the USFWS as habitat for the kingfisher and needed to offset impacts of the proposed action. The DON and USFWS recognize that the designation of the 5,234 acres (2,118 ha) may also provide a conservation benefit to other ESA-listed species with similar habitat requirements (e.g., Mariana crow, Mariana fruit bat).

7.7.9 Marine Biological Resources

Current Health and Historical Context. As summarized in Sections 3.9, 4.2.9, 5.5.9, and in this section, the overall health of Guam's reefs has declined over time, with impacts from global and local stressors contributing to a significant decline over recent decades. The average live coral cover was approximately 50% in the 1960s, but dwindled to less than 25% by the 1990s, with only a few areas having over 50% live cover. In the past, however, Guam's reefs have recovered after drastic declines. For example, an outbreak of the crown-of-thorns starfish in the early 1970s reduced coral cover in some areas from 50-60% to less than 1%, but 12 years later, live coral cover was restored to pre-1970s conditions. The more common trend, however, is the decline of Guam's reefs over the past 40 years, consistent with a general global decline of this resource.

Prior to Spanish conquest, the Chamorro and other Pacific societies retained property rights within the family that extended out to sea. While fishing occurred, it was likely done at sustainable levels. Harvesting of sea turtles and their eggs also occurred. The effect of pre-WWII events on the current

health of Guam's marine biological resources is unknown. There was likely coral damage due to storm and wave events, but low levels of human-induced stress because population and industry levels were much lower than today.

The creation of Inner and Outer Apra Harbor during WWII required extensive dredge and fill. The navigational approach to Inner Apra Harbor was dredged. In addition to the direct physical impact on marine resources due to the war, indirect impacts resulted from an increase in soil erosion as described under the terrestrial biological resources section. The sediment load in the coastal waters likely had an impact on the health of the reefs. Post-WWII dredging in Apra Harbor resulted in a decline of coral communities and compensatory mitigation proposals are being implemented to restore the ecosystem function in other watersheds.

Since WWII, the health of marine biological resources has been affected by an increasing population, and associated recreational, industrial and commercial operations that impact the natural environment. More recently, the most serious threats to Guam's reef health have been identified as sedimentation (from illegal wildfires, improper development, and upland erosion), stormwater runoff and associated pollutants such as fertilizers and oil (from inadequate protections during coastal development and insufficient stormwater management practices and infrastructure), and overfishing.

A variety of land-based activities have contributed to nutrient input to nearshore waters. A 2010 assessment by GEPA determined that while most of the 24 assessed bays met water quality guidelines for recreational activities and harvesting, 11 of the bays were impaired. Over 700 swimming advisories due to bacterial counts in marine waters were issued in 2009, likely stemming from faulty septic tanks and non-compliance by treatment facilities with NPDES regulations for various parameters. In 2009, two treatment plants that had previously been the source of untreated sewage into nearshore waters were renovated to repair the leaks and extend the outfall pipes further offshore.

Adding to these stressors are the more recent emergences of crown of thorns outbreaks, coral disease, and coral bleaching. There are six coral diseases that affect Guam's reefs, with over 10% of corals observed in one study, affected by at least one disease.

A total of nine special-status species potentially occur within the nearshore waters of Guam: three fish, three sea turtles, and three coral species (Tables 3.9.1-1 and 3.9.1-2). In April 2013, NMFS found that the Indo-West Pacific Distinct Population Segment of the scalloped hammerhead shark be listed as threatened (NMFS 2014a) under the ESA. Information on the distribution of scalloped hammerhead sharks around Guam is limited, but Guam's Outer Apra Harbor has been noted for neonate and juvenile aggregations. The humphead wrasse and bumphead parrotfish are NMFS Species of Concern. NMFS announced in November 2012 that the bumphead parrotfish did not warrant listing as threatened or endangered under the ESA following a status review (NMFS 2012a). NMFS also found in September 2014 that the humphead wrasse did not warrant listing as threatened or endangered under the ESA following a status review, but it is virtually extinct from the waters around Guam (NMFS 2014b). The ESA-listed green and hawksbill sea turtles are threatened by direct harvesting of eggs or adults, beach cleaning and replenishment, recreational activities, debris, incidental take from fishing, and seagrass degradation.

In August 2014, NMFS found three species of coral occurring in the waters surrounding Guam (*Acropora globiceps*, *Acropora retusa*, and *Seriatopora aculeata*) merited listing as threatened under the ESA (NMFS 2014c). The conclusion of a recent *State of the Coral Reef Ecosystem on Guam* assessment was that the health of Guam's coral reefs varies significantly. Reefs unaffected by sediment and nutrient loading, such as those in the northern part of the island and some coastal areas in the south, have healthy coral communities. Guam's reefs have been spared from large-scale bleaching events and coral diseases

which are prevalent in so many parts of the world. A number of Guam's reefs are impacted by land-based sources of pollution and over-fishing. Guam identified land-based sources of pollution as its number one priority focus area in 2002. Sedimentation, algal overgrowth due to decreased fish stocks, and low recruitment rates of both corals and fish are important issues that must also be addressed. Big Blue Reef in Apra Harbor is considered one of the healthiest reefs in the harbor due to the reef's protection from water quality factors associated with Inner Apra Harbor and ship-induced sediment resuspension that impact other reef systems in the harbor. Reefs off Dry Dock Island, which was artificially created during WWII, are considered to also be among the healthiest reefs in the harbor, primarily due to protection from stressors. In contrast, the coral reef along Polaris Point, which was also constructed during WWII, is of marginal quality and has the greatest signs of stress, including high levels of total suspended solids likely derived from watershed discharge. Recreational activities result in physical damage to coral reefs, and fish feeding by snorkelers and divers can alter fish behavior. Recent studies conducted in support of this SEIS identify evidence of anchor and/or anchor chain damage to coral in Apra Harbor, including the formation of a rubble field on the southern side of the floating dry dock. Movement of mooring chains on the southern side of the floating dry dock has produced a significant rubble field, although mooring chains on the northern (outer) side of the floating dry dock do not appear to have caused similar damage.

On a more global scale, the nine most important threats to reef-building corals include: ocean warming (high), disease (high), ocean acidification (medium-high), trophic impacts of fishing (medium), sedimentation (low-medium), nutrients (low-medium), sea-level rise (low-medium), predation (low), and collection and trade (low), as stated by the Coral Biological Review Team assembled to complete comprehensive status reviews of the 82 species of reef-building coral initial proposed for ESA-listing. Potential impacts from these threats to coral are related to the intensity and duration of the threat over time and space, and nearly all are expected to increase over the long term. Ocean warming, disease, and ocean acidification are discussed more under the "Potential Cumulative Effects" section below.

Sixteen recently completed projects have the potential to contribute to cumulative effects to marine biological resources on Guam (see Table 7.6-1). Nine of these projects could have a beneficial impact because they reduce erosion or improve infrastructure, such as, Northern District WWTP (N-32) and Construction of Golf Pier Pipeline Replacement (AH-16). Projects with potential adverse impacts are coastal projects: Gregorio D. Perez Dock A&B Steel Pile Extension and Water Blasting (C-19), and Kilo Wharf (AH-4).

Thirty present projects were identified and 23 of these could have a beneficial impact because they are infrastructure improvements, such as: Wastewater System Planning (G-12), Facilities Plan/Design for WWTP (G-13), Marine and Port Security Operations Center (AH-13), Old Agat Wastewater Collection (Phase II) (S-10), Hagåtña Sewage Treatment Plant Improvements and Effluent WWPS (C-42), Facilities Plan For Hagåtña STP Improvements and Effluent WWPS (C-41), and Modernization Program for Port Reconfiguration, Maintenance, and Repair (AH-11), and Northern District WWTP (N-32), Agaña Water Treatment Plant Interim Measures (C-43), and Wastewater Collection System Replacement/Rehabilitation Program (G-19). Projects with a potential adverse impact include new or improved wharves and piers, such as Gregorio D. Perez Marina Dock C repairs (C-40), military training ranges (MITT [G-23]) and port modernization program (AH-11).

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Impact. As summarized in Tables 7.4-1 and 7.6-2, all of the collective action alternatives would result in less than significant long-term impacts to marine biological resources. These impacts are indirect and tend to be associated with the proposed population increase, which would increase pressure on marine

recreational resources around the island and increase the volume of wastewater effluent. With planned GovGuam improvements to wastewater treatment plants, there would be no impact on marine resources due to wastewater effluent in the long-term. There may be impacts to marine conservation areas that are adjacent to the cantonment alternatives but this would not apply to the Barrigada cantonment (Alternative D). Similarly, there would be no impact associated with the operations of the LFTRC alternatives at NAVMAG (Alternatives 2, 3, 4) because they are not affecting submerged lands. The less than significant impacts identified for these coastal LFTRCs are related to the remote chance that there would be rounds of ammunition that end up in the ocean. No training exercises in the water are planned; therefore, no direct impact to marine resources is anticipated.

The restricted public access to the NWF LFTRC SDZ could be viewed as a beneficial impact to marine resources because there would be reduced impacts on marine resources associated with recreational use. The 2010 ROD-Related Actions (Section 6.2) and the additive actions (Section 6.1) would have less than significant or no impact on marine biological resources. There would be direct short-term localized construction-related impacts associated with the Apra Harbor wharf improvements, but the impacts would not have a long-term impact on the health of the resource.

Reasonably Foreseeable Actions that Affect Marine Biological Resources. Two reasonably foreseeable future projects are anticipated to contribute to a cumulative effect to marine biological resources on Guam (see Table 7.6-1). X-Ray Wharf Improvements (AH-10) may have short-term adverse impacts to marine biological resources because there is in-water work. The Umatac-Merizo STP Replacement (S-18) would have a beneficial impact because it is in infrastructure improvement.

Potential Cumulative Effects. The collective action alternative impacts on marine biological resources are indirect and less than significant, and primarily associated with the proposed increase in island population. Two collective action alternatives have SDZs over water and there is slight potential for direct impact to individuals of a species but there would be no impact to the overall health of the population. Most of the recently completed, present, and reasonably foreseeable projects would have a beneficial impact on marine biology because they are sewer infrastructure improvement projects. MITT is an exception.

There would be a low additive cumulative effect (see Table 7.6-2) because the waterfront projects identified are few, the direct impacts would be localized, and there are regulatory controls to mitigate the impacts. The collective action alternatives would not impact the resiliency of marine biological resource health in responding to future stressors.

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. Additional mitigation measures may be considered based on consultations with regulatory agencies and will be discussed in the ROD, as appropriate.

7.7.10 Cultural Resources

Current Health and Historical Context. As summarized in Sections 3.10, 4.2.10, 5.5.10, and in detail in the 2010 Final EIS (Volume 2, Section 12.1: Affected Environment, pages 12-1 to 12-38), cultural resources include Pre-Contact and Post-Contact archaeological resources, architectural resources and traditional cultural properties. The main Mariana Islands were settled before 1500 B.C. The Pre-Latte period was from 1500 B.C. to 1000 A.D.; evidence of residency and community composition is difficult to identify. The Latte Period (1000 A.D. to 1300 A.D.) is distinguished by the presence of *latte* stone structures. The Post-Contact period begins in 1521 A.D. with Magellan's landing. Subsequently, disease and war decimated the local population, reducing it from 40,000 in 1668 to 1,800 in 1690. In the 19th

century, Guam was ceded to the U.S. by Spain. Between 1898 and 1941, Guam served as a coaling and fueling station for Naval ships and as a landing place for the Pan-American transpacific air clippers. In 1941, Japan attacked Guam and in 1944, the U.S. commenced an intensive bombardment. After the U.S. captured the island there was a massive build-up of military forces, including construction of five new airfields. Since the 1960s, tourism has been an important industry.

Since 1966, most potential impacts to cultural resources as defined under NEPA have been evaluated consistent with NHPA and the Criteria of Adverse Effect set forth at 36 CFR 800.5. Overall the health of cultural resources can be impacted as a result of inadvertent disturbance, construction activities, and natural degradation and damage due to erosion. On Guam, for example, prior to the enactment of NHPA and NEPA, activities related to WWII resulted in a general degradation of the health of cultural resources. Today, while some areas have been heavily impacted, there are other areas that remain where cultural resources are significantly intact. In consideration of this, the overall health of cultural resources is moderate.

Sixty-one recently completed projects with the potential to contribute to a cumulative effect to cultural resources on Guam were identified (see Table 7.6-1). Any project that results in ground disturbance could contribute to a cumulative effect on cultural resources, such as Ukudu Workforce Village (e.g., N-28), roadway construction or improvements (e.g., Route 25 [C-6]), or structures like the Veterans Clinic (C-3) and the Bayview 5 Luxury Hotel (C-4). No projects were identified that would have a beneficial effect on cultural resources.

Sixty-eight present projects with the potential to contribute to a cumulative effect on cultural resources on Guam were identified (see Table 7.6-1). Many of these projects are residential construction (e.g., Emerald Ocean View Park [C-21]) or roadway construction or improvements (e.g., Route 4, Togcha River to Ipan beach park [S-20]), but there are a variety of other activities that could have an adverse cumulative effect on the resources, such as Lateral Conversion of Powerlines to Underground Lines (G-11). One project, the new Guam Museum (C-24) would have a beneficial impact on cultural education.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. All collective action alternatives would result in significant mitigable impacts to Guam's cultural resources as a result of the cantonment/family housing and LFTRC component, as summarized in Tables 7.4-1 and 7.6-2. The exception is the significant impact identified for the collective action alternatives that involve the NWF LFTRC (A-5, B-5, C-5, D-5, and E-5), due to the restriction of public access to a NRHP-eligible site at Ritidian Unit of the Guam NWR. Table 6.2.4-2 summarizes the collective action impacts, including the numbers of historic properties affected. Direct construction impacts alone would result in adverse effects to a minimum of 20 known historic properties under collective action alternative D-1 and a maximum of 49 historic properties for collective action alternative A-5. In addition, there are undetermined effects to historic properties and archaeological sites that have not been evaluated and impacts to culturally important natural resources. The ROD-Related Actions contribute to the impact on cultural resources, but the majority of the impact would be related to the cantonment/housing and LFTRC development.

Each of the collective action alternatives would contribute to the decline in preservation of cultural resources. Other factors unrelated to the project, such as vandalism and weathering, would continue to adversely impact cultural resources.

Reasonably Foreseeable Actions that Affect Cultural Resources. Fourteen reasonably foreseeable projects are anticipated to contribute to a cumulative effect to cultural resources on Guam (see Table 7.6-1)

because they are likely to involve ground disturbance. These projects include road construction (e.g., Route 17 Rehabilitation & Widening [S-27]), and Sigua Highlands (C-47).

Potential Cumulative Effects. There would be cumulative effects associated with the collective action alternatives and the recently completed, present, and reasonably foreseeable actions of other federal agencies, local governments, and the private sector on cultural resources on Guam. These impacts may be linked to projects, developments, and actions that do not meet the criteria for a federal undertaking as defined in the NHPA. The impacts of these actions cannot be determined with specificity at this time.

Implementation of the collective action alternatives in conjunction with recently completed, present, and reasonably foreseeable actions would have a cumulative effect on cultural resources. The magnitude of the impact would be strong because the impacts are long-term and generally irreversible. Disturbance or destruction of these cultural resources would further diminish the regional historic record, thus decreasing the potential of its overall research contribution. Reduced access to cultural sites, whether for cultural practices or academic study, would also diminish the cultural resources of Guam.

Need for Mitigation. Potential mitigation for the impacts of the collective action alternatives is described in Section 6.2 of this SEIS. To the degree possible, impacts to historic properties and other significant cultural resources would be avoided or minimized during the planning process. If avoidance is not possible, potential mitigation measures to resolve adverse impacts to historic properties and reduce adverse impacts to cultural resources resulting from the implementation of collective actions would include the following:

- support Guam SHPO's update of the Guam Historic Preservation Plan (GHPP);
- beginning in 2017, update the Guam Synthesis with information from DoD studies in concert with the GHPP;
- nominate two or more historic properties on DoD land per year for listing in the NRHP;
- In accordance with the 2011 PA, support construction of a Guam Cultural Repository and seek congressional authorization to transfer DoD funding for the construction. The $12,000,000 appropriated under the FY 2012 Consolidated Appropriations Act (Public Law 112-74) for a Guam Cultural Repository facility remains in place. The appropriation provides funding for a repository for curation of archaeological collections on Guam and to serve as a source of information on Guam history and culture; and
- advocate to other federal agencies to provide funding for the Guam Museum Complex.

With the implementation of these measures and processes as outlined in the 2011 PA, it is expected that significant cumulative impacts would be partially mitigated but not to a less than significant level.

No additional mitigation measures are proposed for cumulative effects on cultural resources.

7.7.11 Visual Resources

Current Health and Historical Context. As summarized in Sections 3.11, 4.2.11, 5.5.11, and in this section, the visual quality of Guam prior to WWII was presumably high due to the prevalence of open space. Urban development and introduction of invasive species are likely the most notable cause for change in visual environments; the physical characteristics of a development as well as location, influence the resulting visual impact. Natural disasters, such as typhoons and earthquakes, contribute to the degradation of the appearance of existing developments. Some developments are abandoned and fall into disrepair with an adverse impact on visual resources. When the economy is good, there is a tendency for increased development or property improvement. Conversely, during hard economic times, buildings are not maintained or are abandoned. The visual resources trend over time is not linear, but is influenced by

critical events. In general, there is a trend toward increased development. GovGuam reviews development proposals to verify they are consistent with zoning objectives with respect to density and do not interfere with valued scenic views. There is no regulatory threshold regarding visual health of Guam.

Eleven recently completed projects that affect visual resources on Guam are identified in Table 7.6-1. Those with potential adverse impacts include: Workforce Housing (N-10), Talo Verde Estates (C-2), Bayview 5 Hotel (C-4), and Amusement Park (C-12). These are all projects that alter the visual experience from adjacent roadways relative to what was previously on the various sites. Layon Landfill (S-3) affects an area that was formerly open space; however, there is little traffic in the area. One project could have a beneficial visual impact: Upgrade of Existing 14 Megavolt Ampere Power Transformer to 30 Megavolt Ampere and Underground Line (G-5).

Nineteen present projects that affect visual resources on Guam are identified in Table 7.6-1. Two of these projects could have a beneficial impact because it involves the lateral conversion of power lines to underground lines (G-11) and Reforestation of Masso Reservoir (AH-2). GovGuam and UoG Wind Turbines (S-4 and C-32) are tall features that are visible from a distance and may impact views. Anti-terrorism/Force Protection Perimeter Fencing is an example of a military base project that would be visible to the community.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Tables 7.4-1 and 7.6-2, collective action alternatives would have impacts on visual resources that range from less than significant to significant. The adverse impacts are related to the LFTRC component of the collective action alternatives. The collective action alternatives A-5, B-5, C-5, D-5, E-5, A-2, B-2, C-2, D-2, and E-2 would have less than significant impacts on visual resources due to large-scale development with limited public views. The significant impacts associated with the remaining alternatives include two of the NAVMAG LFTRC alternatives that would be visible from Jumullong Manglo Overlook and Mount Lamlam and their associated hiking trails to two of NAVMAG LFTRC (LFTRC Alternatives 3 and 4). Significant mitigable direct impacts would be due to alteration of the views from Route 15 to the proposed LFTRC (Alternative 1) Potential mitigation measures are proposed to restore/maintain natural vegetation to the extent practical. Less than significant impacts would be associated with all collective action alternatives due to increased building density for cantonment/family housing. The development would be designed to be consistent with the 2011 Installation Insurance Plan. While the base would not be accessible to the public, some features would be publicly-visible including the entrance gates, perimeter fencing and peripheral landscaping and vertical infrastructure such as light posts and water tanks. These, and the remaining features of the new base, would present a united design template as outlined in the Installation Insurance Plan. No significant impacts to visual resources were identified for the 2010 ROD-Related Actions (Section 6.2) and the additive impacts (Section 6.1). The collective action alternatives would not contribute appreciably to the declining trend in visual resources. Other factors unrelated to the project, such as natural disasters and economic downturns, would continue to adversely impact visual resources.

Reasonably Foreseeable Actions that Affect Visual Resources. Three reasonably foreseeable future projects are anticipated to contribute to a cumulative effect to visual resources on Guam (see Table 7.6-1). The one public utility project that might adversely impact open space is the GovGuam 60 MW Power Plant (G-6). The remaining projects include large development proposals that could impact open space, such as: Sigua Highlands (C-47), and the Territorial Prison (G-10).

Potential Cumulative Effects. There would be cumulative effects associated with the collective action alternatives in conjunction with recently completed, present, and reasonably foreseeable actions of other

federal agencies, local governments, and the private sector on visual resources on Guam. The implementation of any development project would likely remove open space and potentially result in an adverse impact. Some projects may replace abandoned or deteriorated buildings that would result in an improvement to visual resources. The GovGuam reviews development proposals and impacts to valued scenic viewpoints would be identified and considered in the permit application process.

Visual impacts are geographically limited. The recently completed, present, and reasonably foreseeable actions in the southern part of Guam (Figure 7.5-4) are unlikely to contribute to a cumulative impact in conjunction with the NAVMAG collective action alternatives in the south. There would be no cumulative impact associated with the 2010 ROD-Related Actions in Inner Apra Harbor. The Barrigada cantonment (Alternative D) is located in central Guam (Figure 7.5-2) and open space would be reduced, but most of the actions identified in the area are low profile road improvement projects; therefore, no cumulative impact is anticipated on the visual resources in Central Guam. Northern Guam has the greatest potential for cumulative impacts due to the number of recently completed, present, and reasonably foreseeable actions and the potential for both the cantonment, LFTRC and the Air Combat Element of the 2010 ROD-Related Actions to be located in the north. However, most of the visual impact of the collective action alternatives in the north would occur within the installation boundary and would not be visible to the public.

For these reasons, there would be a low additive cumulative effect between the collective action alternatives that would be located within DoD installations and the recently completed, present, and reasonably foreseeable future projects with respect to impacts on visual resources (see Table 7.6-2). The low additive impact would be limited to the northern part of Guam. No additive impact is anticipated to other areas of Guam.

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. No additional mitigation measures for cumulative effects are proposed.

7.7.12 Ground Transportation

Current Health and Historical Context. Sections 3.12, 4.2.12, 5.5.12 provide information on current health of the resource. Periodic master plans and roadway studies have been prepared by GovGuam to assess roadway and traffic conditions to identify and prioritize roadway and traffic improvement projects. The most recent comprehensive planning effort is the 2030 Guam Transportation Plan, published in December 2008. Forecasts for population and employment through the year 2030 were used to develop an integrated strategy for a multimodal (e.g., vehicle, pedestrian, mass transit) transportation system. The roadway conditions vary from acceptable (no major safety issues), to poor (minor safety issues) to unacceptable. There is a bus system that includes a fixed route, and service for the handicapped; however, there are concerns with scheduling that result in poor ridership. Outside of military installations, designated bicycle lanes are not available and sidewalks are limited to main routes in urbanized areas.

The traffic on roadways is driven by island population and employment related to land use development. Roadway condition is a function of construction material, age, vehicle type, traffic volume, and natural influences such as climate, typhoons, and earthquakes. Since 1950, the population has continued to increase on Guam. The future trends in population growth are expected to increase and continue through 2030; however, the Guam Transportation Plan considered increases related to the military relocation. The roads serving Dededo and Tamuning are currently the most congested because they serve major residential and employment centers. Roadway improvements were identified to address projected 2030 traffic issues, and projects would be implemented as funds become available. Sections 4.2.12 and 5.5.12

describe the baseline conditions for the specific roadways that would be affected by the collective action alternatives, assuming the improvements identified in the Plan are implemented. Island-wide there are an estimated 12 intersections in 2014 and 24 in 2030 that would have the poorest LOS. Although some projects are programmed for funding, traffic conditions are projected to deteriorate on Guam. The natural influences on roadway conditions would continue into the future.

There are private shopping and tour buses that operate among Micronesian Mall, KMART, Guam Premier Outlets and other destinations. The recently established GRTA is responsible for public transit functions. It approved the Guam Transit Business Plan in January 2010, which includes purchasing new buses, constructing a bus maintenance facility, and modifying the bus schedule. Pending funding, a future trend is for improvements to bus service. Guam Public Law requires the consideration and construction of bicycle and pedestrian paths with all new road construction projects. The 2030 Guam Transportation Plan also identifies a plan for bicycle and pedestrian facilities. New developments and roadway projects would include pedestrian and bicycle facilities and improve pedestrian and bicycle options; however, without adequate funding, the existing deficiencies in facilities are likely to continue. The FHWA and other federal transit funding can be used for bicycle lanes.

Twenty-nine recently completed projects with the potential to contribute to a cumulative effect to roadways on Guam were identified (see Table 7.6-1). Most (20) of these projects would have a beneficial impact because they are roadway improvement projects that would improve traffic LOS, including Route 25 (C-6) and Route 8/10/16 Tri-intersection (C-16). Residential construction (e.g., N-10) and hotel development (e.g., C-4) would have an adverse impact to roadways because they induce traffic.

Thirty-two present projects with the potential to contribute to a cumulative effect to roadways on Guam were identified (see Table 7.6-1) and 17 are likely to have a beneficial impact. These beneficial projects include, Route 1-8 Intersection Improvements & Agaña Bridges Replacement (C-29). Residential construction (e.g., Sagan Bonita [C-26]) and Guam Regional Medical Centers (e.g., N-38) may have an adverse impact to roadways because they induce traffic.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Section 6.2 of this SEIS, the collective action alternatives would have less than significant impacts on off-base traffic LOS. Less than significant impacts were identified for increased potential for collisions with bicyclists and pedestrians under all collective action alternatives. No long-term impacts were identified to on-base traffic. The 2010 ROD-Related Actions would have less than significant impacts on traffic.

The significant direct impact on LOS is due to the pairing of each LFTRC and cantonment/family housing alternative and most of the impacts are mitigable to less than significant (see Additive Impacts, Section 6.1). Specific roadway improvement projects were identified as potential mitigation for significant impacts identified for Finegayan and Finegayan/South Finegayan cantonment/family housing alternatives (i.e., A-1, A-2, A-3, A-4, A-5; B-1, B-2, B-3, B-4, B-5; E-1, E-2, E-3, E-4, E-5). With implementation of the potential mitigation measures described in Section 6.1, traffic would improve to an acceptable LOS for affected roadways and intersections. The cantonment alternatives include bike lanes that are segregated from vehicle lanes resulting in a beneficial impact on multimodal traffic and safety. Potential mitigation measures were not identified for the significant impacts at the remaining alternatives, involving cantonment at AAFB or Barrigada.

Reasonably Foreseeable Actions that Affect Ground Transportation. Eleven out of 12 reasonably foreseeable projects are anticipated to have a beneficial impact on ground transportation, because they are roadway improvement projects (see Table 7.6-1). Examples of beneficial projects include: Route 26/25

Intersection Improvements (C-31), Route 10A, Route 1/Tiyan Intersection and Route 5 Rehabilitation & Widening (S-29). The Sigua Highlands project (C-47) would have an adverse impact on traffic because it would induce more traffic into the area.

Potential Cumulative Effects. There would be cumulative ground transportation effects associated with the collective action alternatives in conjunction with recently completed, present, and reasonably foreseeable projects that induce traffic. Very few growth-inducing projects were identified among the recently completed, present, and reasonably foreseeable projects. The adverse effects are adaptively managed through roadway improvement projects. A large number of roadway improvement projects throughout the island are already planned by GovGuam DPW to address LOS deficiencies, but these are subject to funding availability. The magnitude of additive impact resulting from every collective action alternatives would be strong (see Table 7.6-2) because the infrastructure improvement projects are subject to funding availability and there may be a lag time before the improvement projects are constructed.

Need for Mitigation. Specific roadway improvement projects are proposed in Chapter 6.1 of this SEIS as potential mitigation measures for the significant impacts due to the collective action alternatives. GovGuam continues to update their transportation program to address existing LOS deficiencies. No additional mitigation measures are proposed for cumulative effects.

7.7.13 Marine Transportation

Current Health and Historical Context. As summarized in Chapters 3, 4 and 5, and in the 2010 Final EIS, during WWII, port capacity was greatly expanded. As new military ships are brought to Guam and military missions change, there is always the potential for an increase in military marine traffic. The commercial traffic is a function of population and general economic health of the island. The number of non-military vessels visiting the Port of Guam would continue to reflect the need to service the population and economic growth.

Three out of five recently completed projects have the potential to contribute to a beneficial cumulative effect to marine transportation on Guam (see Table 7.6-1) because they are port improvement projects, including Kilo Wharf Extension (AH-4). Population inducing projects may increase the shipping of goods, including PRTC Warrior Barracks (N-12).

Six out of 11 present projects have the potential to contribute to a beneficial cumulative effect to marine transportation on Guam (see Table 7.6-1), including Romeo Wharf Improvements (AH-21), Guam Port Modernization Projects (AH-11), and GovGuam Agat Marina Dock A Repair & Renovation (S-16). Projects with potential to increase shipping of goods include, Pacific Air Power Resiliency (N-26).

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Tables 7.4-1 and 7.6-2, each of the collective action alternatives would result in less than significant impacts to Guam's marine transportation. There would be an increase in vessel traffic to the Port of Guam that would be the same for each of the collective action alternatives. This increase would not exceed the port's capacity. There has been a steady and substantial decline in the number of commercial vessels visiting the Port of Guam from 1995 through 2008 (2,924 to 1,022 vessels), the additional traffic that would be associated with the collective action alternatives would be well below the 1995 peak number of vessels visiting the Port of Guam.

Reasonably Foreseeable Actions that Affect Marine Transportation. One reasonably foreseeable future project is anticipated to beneficially contribute to a cumulative effect to marine transportation at Guam, X-Ray Wharf (AH-10) (see Table 7.6-1).

Potential Cumulative Effects. There would be an additive impact between the collective action alternatives and the recently completed, present, and reasonably foreseeable future projects, but the magnitude of additive impact resulting from the collective action alternatives would be low (see Table 7.6-2). Although the volume of goods may increase to support the increases in population, the increase in ship traffic is considerably lower than vessel traffic experienced in the late 1990s. The commercial port is not at risk of being unable to meet the anticipated increases in demand.

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. No additional mitigation measures for cumulative effects are proposed.

7.7.14 Utilities

Current Health and Historical Context. As summarized in Chapters 3, 4, and 5, and in this section the trends in utility demand are tied to population growth and constructed facility growth that has generally increased over time. Electrical power demand is typically estimated based on the square footage of constructed facilities. Water and wastewater quantities are forecast using population and industrial uses. Solid waste quantities are estimated using population, commercial/industrial operations, and construction activity for C&D debris and green waste.

In the utility studies prepared for this SEIS, the forecast electrical power demand was based on planned DoD projects and their square footage/type of facility. In addition, the analysis forecast the electrical power demand increases for civilian projects based on population growth forecast, both induced growth including construction workforce and organic civilian growth forecast (independent of the proposed Marine Corps Relocation). Based on these estimates, there is sufficient power generation capacity to meet current and forecast demands through the year 2028. GPA may have a different approach to civilian power demand forecasting that could affect their future plans.

The GWA potable water distribution system is identified as poor; it does not meet basic flow and pressure requirements for all customers. GWA is currently operating under a stipulated order last amended in October 2011. A program management consultant has been contracted to manage the required improvement projects, and some projects have been completed while others are in progress. In addition, the leak detection and repair program has yielded results based on GWA observed positive operational characteristics. However, it is too soon to confirm these observations. The recently completed USEPA NEIC Water Inspection Report revealed continued deficiencies in the GWA potable water system.

The GWA wastewater infrastructure has had a legacy of deferred maintenance and minimal capital improvements causing the systems to deteriorate over the years and resulting in violations of NPDES permit limits at WWTPs. The wastewater systems would continue to degrade until capital improvements are made. The current major wastewater compliance requirements for GWA are covered under the 2011 Court Order, significant findings for wastewater from a USEPA NEIC inspection conducted in 2012, and 2013 NPDES permits requiring treatment system upgrades for the Northern District WWTP and Agaña WWTP.

In the years since the 2010 Final EIS, the GWA has made progress in complying with the 2011 Court Order, including addressing significant findings from the 2012 USEPA NEIC inspection. However, implementation of capital improvement projects and improvements to the operation and maintenance of the existing GWA wastewater infrastructure are in the initial stages and will require several years and significant funding to achieve full compliance. A program management consultant has been contracted by the GWA to assist in the management of the required court ordered projects. Some projects have been

completed while others are in progress. The Northern District WWTP and the Agaña WWTP primary treatment capabilities have been improved subsequent to the 2010 Final EIS through chemically enhanced treatment. The effluent today is of better quality than in 2010. However, USEPA issued the 2013 permits requiring effluent quality be consistent with secondary treatment and Guam Water Quality Standards, including those for nutrients. The 2013 NPDES permits for the Northern District WWTP and Agaña WWTP require upgrading these plants to achieve compliance. These upgrades are required whether or not the proposed action proceeds and will result in improved effluent and receiving water quality.

The DON proposes to explore ways to resolve key solid waste issues, specifically the status of the Naval Base Guam Landfill permit and handling of special wastes not accepted at Layon Landfill, through the Solid Waste Working Group that was established with USEPA and GEPA on July 24, 2014. During the September 19, 2014 meeting of the Solid Waste Working Group, GEPA indicated that they will formally respond to DON correspondence with regards to issues relative to the Naval Base Guam Landfill. The Layon Landfill and the permitted private hardfill facilities are operating within their regulatory requirements. The proposed action would be in compliance with all applicable GEPA solid waste permit terms and conditions that routinely include specific measures to protect human health and the environment. All other projects on Guam would utilize permitted solid waste management and disposal facilities.

Of 19 recently completed projects (see Table 7.6-1), 15 would have a beneficial impact on utilities because they are infrastructure improvement projects, such as: Fiber Optic Installation (C-20), Deep Well Rehabilitation (G-17), Implement Groundwater Rule (G-16), Ugum Water Treatment Plant Refurbishment (S-6), and South Ramp Utilities Phase 2 (N-11). Population inducing projects may increase the demand on utilities, including PRTC Warrior Barracks (N-12).

Of the 31 identified present projects involving utility improvements (see Table 7.6-1), 29 could have a beneficial impact on utilities, including: Baza Gardens STP replacement (S-14), Wind Turbines (C-32, S-4), Wastewater Collection System Replacement/Rehabilitation Program (G-19), Hagåtña STP Improvements (C-41), Northern District WWTP (N-32), and Water Booster Pump Station (G-15). Projects with potential to increase demand on utilities include Pacific Air Power Resiliency (N-26).

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Tables 7.4-1 and 7.6-2, less than significant direct impacts were identified for power, solid waste and IT/COMM under all collective action alternatives. The *Utilities* direct and indirect impact analysis on infrastructure capacity addresses population growth and planned DoD projects through 2028; therefore, there may be an overestimate of the potential for cumulative impact on utilities in this section. The collective action alternatives would place a greater demand on these utilities but there is sufficient capacity or the required facilities to meet the demand are included in the proposed action, such as IT/COMM. The new GovGuam Layon Landfill was designed to accommodate the 2010 Final EIS proposed action, which would have a much higher solid waste generation rate. The demands on utilities are directly related to the proposed population growth and induced growth, which would be the same for all collective action alternatives. 2010 ROD-Related Actions contribute a less than significant impact to the collective action impact. The LFTRC would have very little direct or indirect impact on utilities. Significant mitigable impacts were identified for potable water and wastewater.

Potable water: Short-term significant localized impacts to potable water were identified in the NGLA based on a USGS groundwater model (USGS 2013). The impacts are potentially mitigable by DoD through enhanced water conservation measures, adjustment of pumping rates at DoD wells, and reduction in withdraws from the NGLA. In addition, DoD would continue to support the GWRDG. The long-term

impacts to potable water would be less than significant. Eleven additional DoD wells are included in the proposed action.

Wastewater: Significant mitigable impacts on wastewater were identified due to sewage treatment plants requirements to meet 2013 NPDES permits. Direct and indirect wastewater impacts from DoD and organic civilian population growth would be estimated to increase the wastewater flow to approximately 7.8 MGd (29.5 MLd). Performance, permit issues, and the timeframe to implement treatment system upgrades to meet 2013 NPDES permit requirements remains to be resolved for the Northern District WWTP, which is an issue independent of the proposed action. The Agaña WWTP would not receive direct DoD wastewater flows from the proposed action, but would be indirectly affected by the military relocation from wastewater flows from the indirect impacts from the imported construction workforce (during the construction phase only) and induced civilian growth. The estimated increased wastewater flow to the Agaña WWTP due to the proposed action only is 0.04 MGd (0.15 MLd). Similarly, the GWA southern WWTPs (Agat-Santa Rita WWTP, Baza Gardens WWTP, Umatac-Merizo WWTP, and Inarajan WWTP) would not receive direct DoD wastewater flows from the proposed action except for potential and minimal flow to Inarajan WWTP from LFTRC Alternatives 3 and 4 (as an optional but not recommended solution), but would be indirectly affected by the military relocation from indirect wastewater flows from the induced civilian growth as well as organic civilian growth in the region. The increased wastewater flow from indirect impacts from the proposed action to the four southern WWTPs is estimated to total 0.02 MGd (0.075 MLd). The Guam Legislature has recently authorized GWA to finance improvements to its wastewater systems in southern Guam.

Reasonably Foreseeable Actions that Affect Utilities. Three reasonably foreseeable future projects are anticipated to contribute to a cumulative effect to utilities on Guam (see Table 7.6-1). Two of these projects are utility improvement projects with potential beneficial impacts: the 60 MW Power Plant (G-6) and Umatac-Merizo STP Replacement (S-18). The future project that might induce growth or have other indirect impact on utilities include: Sigua Highlands (C-47).

Potential Cumulative Effects. There will be cumulative effects associated with the collective action alternatives and the actions of other federal agencies, local governments, and the private sector on utilities on Guam. Population increases are the cause of direct and indirect impact associated with the collective action alternatives. A few growth-inducing projects were identified from the recently completed, present, and reasonably foreseeable projects; however, there are pre-existing deficiencies that are being corrected, specifically for wastewater. The magnitude of the cumulative effect is moderate because the impacts are regional, the GovGuam building permit review process manages the number of new developments to prevent system failures, and deficiencies in utility service can be addressed by infrastructure improvements, subject to available funding (see Table 7.6-2).

Need for Mitigation. GovGuam has a number of infrastructure improvement projects to address existing deficiencies. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. GovGuam reviews development proposals for utility capacity. No additional mitigation measures for cumulative effects are proposed.

7.7.15 Socioeconomics and General Services

Current Health and Historical Context. Guam's socioeconomic attributes and general services are defined and discussed in detail in the 2010 Final EIS (Volume 2, Chapter 16: Socioeconomics and General Services, Section 16.1: Affected Environment, pages 16-1 to 16-67).

Guam's population, as of the most recent full U.S. Census of 2010, was 159,358. The island's population has grown significantly since becoming a U.S. Territory in 1950 - from a pre-war 1940 level of 22,900 (with a military and dependent population of 1,427) to 59,498 (with a military and dependent population of 26,617) in 1950. As of 2010, 42.5% of Guam's population lived in households on the island's northern region.

Between 1990 and 2000, the percentage representation of Chamorro and Caucasian ethnicities on Guam's population declined, while Filipino and "Other" ethnicities (most often composed of other Asian or Pacific Islander ethnicities) increased. Guam's ethnic makeup changed little from 2000 to 2010. In 2010, 42% of Guam residents were Chamorro or part Chamorro, 25% were Filipino, 8% were other Pacific Islanders, 7% were Caucasian, and 17% were of other races or ethnicities.

Guam's economy has been volatile. The economy stagnated in the 1970s to early 1980s, partly due to the 1973 oil embargo. Tourism peaked between 1995 and 1997 but ended with the Japanese financial crisis in 1997. Super typhoon Pongsona as well as the September 11, 2001 terrorist attacks on the U.S. also affected the tourism market. From 2001 to 2003, Guam's economy contracted. In 2005, tourism was the island's second largest private industry and both the primary Japanese and secondary Korean markets were growing at that time. Many real estate developments were financed and constructed in anticipation of the military buildup as proposed in 2010. Guam's real estate and tourism market slowed at the end of the decade, however, primarily due to the global economic decline and associated economic conditions. In addition, the reduced scope and longer timeframe associated with the 2012 Roadmap Adjustments (see Chapters 1 and 2 of this SEIS) led to a surplus of some housing types and a lower interest in future development.

Seventeen recently completed projects with the potential to contribute to a beneficial cumulative effect to socioeconomics and general services on Guam were identified (see Table 7.6-1). Many of these involved residential construction (e.g., Hemlani Apartments [C-34]) and other projects that provide a public good, such as the Veterans Clinic (C-3).

Nineteen present projects with the potential to contribute to a beneficial cumulative effect to socioeconomic conditions and general services on Guam were identified (see Table 7.6-1). Many of these involve residential construction ranging from worker and low-income housing (e.g., Sagan Bonita [C-26]) to luxury (e.g., C-21) and multi-unit buildings (e.g., Paradise Meadows [N-36]). Others involve commercial development (N-29), and medical facilities (e.g., G-7).

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Tables 7.4-1 and 7.6-2, there would be significant impacts related to an anticipated greater than 2% population growth and the anticipated strain on public service staffing under all collective action alternatives. The significant impacts to public services would be mitigable. Less than significant impacts on economic activity and sociocultural issues were identified for all alternatives. Beneficial impacts could include increased employment and standards of living, and some increase in construction-related business travel. The type and magnitude of the impacts are population dependent and similar for all collective action alternatives. No additive (Section 6.1) or 2010 ROD-Related Action (Section 6.2) impact on socioeconomics and general services was identified.

Reasonably Foreseeable Actions that Affect Socioeconomics and General Services. Four reasonably foreseeable future projects are anticipated to contribute to a beneficial cumulative effect to socioeconomic conditions and general services on Guam (see Table 7.6-1), including the Territorial Prison (G-10) and a 60-MW Power Plant (G-6).

Potential Cumulative Effects. Assessing the potential cumulative effects related to socioeconomics and general services is complicated by the inherent balance of adverse and beneficial impacts for each of the criteria: population change, economic activity, public service, sociocultural, and land acquisition (sociocultural and economic). The socioeconomic impacts are potentially Guam-wide. There are no regulatory thresholds that dictate the economic or sociocultural health; however, there are recognized stressors or threats, such as influx of immigrant populations, ex-migration of a significant employer, land acquisition by the federal government, and decreases in tourism. In general, these adverse impacts are reversible over time. The sociocultural adverse impacts of projects are more difficult to address, but very few of the recently completed, present or reasonably foreseeable projects would have a sociocultural impact. The sociocultural impact of the collective action alternatives is limited to land acquisition (less than significant) and the influx of population (significant). For these reasons, the cumulative effects of the collective action alternatives in conjunction with the recently completed, present, and reasonably foreseeable projects is moderate (see Table 7.6-2).

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. No additional mitigation measures for cumulative effects are proposed.

7.7.16 Hazardous Materials and Waste

Current Health and Historical Context. As summarized in Chapters 3, 4, and 5 of this SEIS, and in the 2010 Final EIS, hazardous material, toxic substance, and hazardous waste handling are collectively referred to as hazardous substances. WWII established a high baseline of environmental releases; but overall, the trend in hazardous substance use is associated with increases in population and industrial activity. During the 1970s, there were numerous local and federal environmental regulations enacted to protect human health and the environment and to closely control and regulate the transport, storage, use, and disposal of hazardous substances. While the trend in use of hazardous substances is expected to increase over time, regulations currently in place minimize the risk of release to the environment as well as the risk to human health. This trend would continue at a more gradual rate of increase. Since the 2010 Final EIS there have been no substantive changes to the quantity of hazardous materials and waste Guam-wide as there has been no increase in the number of regulated facilities (USEPA 2013). Additionally, there have been no substantive changes to law, regulations or policies pertaining to the management of hazardous materials and waste (Section 3.16.2). The impacts are largely related to human activities, but natural events such as typhoons and earthquakes can result in inadvertent releases of regulated hazardous substances.

Twelve recently completed projects have the potential to contribute to hazardous materials and waste cumulative effects on Guam (see Table 7.6-1). Nine of these could contribute adversely, whereas three could be beneficial such as replacement of the Gas Cylinder Storage Facility (C-7) and the Naval Hospital (C-8). The beneficial impacts are based on the presumption that newer, more efficient facilities could potentially use less hazardous materials and produce less hazardous waste. A new industry or industrial facility has potential to adversely impact hazardous materials because they could increase the on-island management of hazardous materials and waste, such as MIRC EIS/OEIS (G-2) and Kilo Wharf Extension (AH-4).

Eleven present projects have potential to contribute to cumulative hazardous material impact (see Table 7.6-1). Five of these could contribute adversely by increasing the amount of materials and waste on island, such as Fuel System Maintenance Hangar (N-51). However, six projects could have a beneficial impact on potential cumulative effects, including POL System Hardened Structures (N-47), General

Purpose Hangar (N-52), PRTC SF Fire Rescue Emergency Management (N-50), and Upgrade JP-8 Receipt Pipeline (C-44) by increasing capacity or repairing existing infrastructure that is associated with the management of hazardous materials and waste.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Tables 7.4-1 and 7.6-2, the collective action alternatives would result in less than significant impacts to hazardous materials management, hazardous waste management, existing contaminated sites and toxic substances. The impacts would be the same for all of the alternatives. The impacts would be associated with an increase in the management of hazardous materials and waste managed. The impacts would be less than significant because the transportation, storage, handling, use, and disposal of these substances is heavily documented, controlled, and regulated at the federal and local level in a "cradle to grave" comprehensive manner. The potential for radon intrusion in new construction would be addressed in facility design. Existing contaminated sites were identified at the NWF LFTRC and these would be avoided to the extent practicable for a less than significant impact.

Reasonably Foreseeable Actions that Affect Hazardous Materials and Wastes. Two reasonably foreseeable projects could contribute to hazardous substances and waste cumulative effects. These projects include the 60 MW Power Plant (G-6).

Potential Cumulative Effects. There will be cumulative effects associated with the collective action alternatives and the actions of other federal agencies, local governments, and the private sector on hazardous materials on Guam. The degree of cumulative effect resulting from the collective action alternatives is considered to be low (see Table 7.6-2) because the existing environmental laws and regulations and associated BMPs and SOPs require that hazardous substances are handled, used, and disposed of in a comprehensive "cradle to grave" manner that inherently reduces the overall risk to human health and the environment.

This projection is based on the assumption that existing hazardous materials, toxic substances, and hazardous waste transportation, handling, storage, use, and disposal procedures and protocols are properly implemented and modified as appropriate to address the increased hazardous substances demand. Most of the recently completed, present, and reasonably foreseeable future projects would increase the management and capacity to handle regulated hazardous substances on Guam. However, these impacts would not contribute appreciably to the increasing trend in the volume of regulated hazardous substances already being handled and managed on Guam.

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. GovGuam reviews development proposals for proper use and management of hazardous materials. No additional mitigation measures for cumulative effects are proposed.

7.7.17 Public Health and Safety

Current Health and Historical Context. As summarized in Sections 3.17, 4.2.17, 5.5.17, and in detail in the 2010 Final EIS (Volume 2, Section 18.1: Affected Environment, pages 18-1 to 18-12), the historical trends in public health and safety are difficult to determine. WWII is the most damaging recent event on Guam's history impacting human health and safety. The trends in public health and safety are a function of changes in population and operations, or industries that involve dangerous materials (e.g., hazardous substances, live ammunition, electromagnetic energy, radiological substances). The socioeconomics section describes changes in population over time. From 1970 to 2000, the population on Guam increased, but declined in subsequent years. The number of occupational and traffic accidents has

increased gradually over the years. The trend in notifiable diseases is increasing gradually, but is related to population. The increase in construction and ground-disturbing activities would increase the risk of uncovering UXO; live ammunition is largely a military activity and changes with the military mission. Guam health and public services (i.e., lack of skilled professionals and lack of up-to-date equipment) are sub-standard due to lack of funding; this trend is likely to continue in the absence of economic development.

Thirty-nine recently completed projects were identified that could result in cumulative public health and safety impacts. Thirty-six would likely have a beneficial impact because they would improve traffic safety (e.g., S-1) or health services (e.g., C-3).

Fifty-seven present projects were identified that could result in cumulative public health and safety impacts. Fifty-two projects may be beneficial because they involve road improvements (e.g., Route 1-8 Intersection Improvements & Agaña Bridges Replacement[C-29]), utility improvements (e.g., S-8), or health care improvements (e.g., N-38). Some military development projects (e.g., N-48, N-39) would have an adverse impact because they could contribute to the perception of Guam becoming a terrorist target.

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effects. As summarized in Tables 7.4-1 and 7.6-2, the collective action alternatives would result in less than significant impacts to public health and safety on Guam for the following categories:

- Healthcare services (notifiable diseases/mental illness)
- Operational safety
- Environmental health (water quality, hazardous substances)
- Traffic incidents

Significant impacts were identified for the collective action alternatives that include cantonment at AAFB (Alternatives C-1, C-2, C-3, C-4, and C-5). During operations, in the event of a munitions transport incident or explosives incident at the North Gate, a significant direct impact related to explosive safety could occur. A less than significant impact was identified for all other collective action alternatives.

Reasonably Foreseeable Actions that Affect Public Health and Safety. Sixteen reasonably foreseeable projects are anticipated to contribute to a cumulative public health and safety impact, 14 of which may have beneficial impacts, such as the Territorial Prison (G-10).

Potential Cumulative Effects. Anticipated impacts to public health and safety would have a cumulative effect when combined with recently completed, present, and reasonably foreseeable actions on Guam identified above. The impact is not quantifiable. There are no regulatory thresholds for public health and safety. The degree of additive impact resulting from the collective action alternatives would be considered to be moderate (see Table 7.6-2) because the cumulative effect is based largely on population increases and available resources, and is island-wide.

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. GovGuam reviews development proposals and advocates for public health and safety. No additional mitigation measures for cumulative effects are proposed.

7.7.18 Environmental Justice and the Protection of Children

Current Status and Historical Context. As summarized in Chapters 3, 4, and 5 of this SEIS, and in the 2010 Final EIS (Volume 2, Section 19.1: Affected Environment, pages 19-1 to 19-8), Environmental Justice is an important concept that was introduced in 1994 by EO 12898. It applies to federal actions.

Guam has a higher percentage of racial minorities, low-income populations, and children, when compared with the continental U.S. Much of the island's population would likely continue to struggle with poverty and access to basic community services, especially when the social and health services are inadequate for the existing population. The existing inadequate roads and utilities would likely continue to deteriorate, having an adverse and disproportionate impact on disadvantaged residents of Guam. It is noted that the collective action alternatives would improve various roads and highways affected by the collective action alternatives.

Forty-three of 46 recently completed projects could contribute to a beneficial environmental justice and protection of children impact on Guam, including Road Safety Improvements (G-1), housing projects such as Paradise Estates (N-2) and Lada Estates (N-31), and public infrastructure projects, such as Layon Landfill (S-3) (see Table 7.6-1).

Sixty-three of 66 present projects could beneficially contribute to environmental justice and protection of children on Guam (see Table 7.6-1). The beneficial projects include residential construction, particularly for low-income housing (e.g., Sagan Bonita [C-26]), a Health Clinic (G-7), and Guam Regional Medical City (N-38). Potential adverse impacts are associated with increases in island population, such as the Pacific Airpower Resiliency (N-26).

Direct and Indirect Impacts of the Collective Action Alternatives that might Contribute to a Cumulative Effect. As summarized in Tables 7.4-1 and 7.6-2, significant impacts were identified for all collective action alternatives. The significant impact is associated with (1) the greater than 2% increase of on-island population that would have an impact on existing public safety staffing levels, and (2) disproportionate socioeconomic impacts on low-income populations. The type and magnitude of the impacts would be similar under each of the collective action alternatives. Less than significant impacts to environmental justice populations were identified operational safety and noise levels, and recreation for all collective action alternatives. Land acquisition would have a less than significant impact on environmental justice populations, except for alternatives that include a LFTRC at AAFB NWF (i.e., A-5, B-5, C-5, D-5, E-5), in which case there is no land acquisition proposed. No additive impacts (Section 6.1) were identified. Less than significant impacts construction phase impacts related to health care service were identified for the 2010 ROD-Related Action (Section 6.2).

Reasonably Foreseeable Actions that Affect Environmental Justice and the Protection of Children. Fifteen reasonably foreseeable projects are anticipated to contribute to a cumulative impact, none of which would like have an adverse impact. Infrastructure improvement projects (e.g., Route 26/25 Intersection Improvements) and public service infrastructure (e.g., Territorial Prison G-10) would likely have a beneficial cumulative effect.

Potential Cumulative Effects. There will be cumulative effects associated with the collective action alternatives and the actions of other federal agencies, local governments, and the private sector on environmental justice and the protection of children on Guam. There are no specific thresholds to measure the cumulative effects of all the projects being considered. The degree of additive impact resulting from the collective action alternatives would be considered to be strong (see Table 7.6-2) because the current status of the population is not resilient to additional stress and the impacts are island-wide.

Need for Mitigation. Potential mitigation measures proposed for avoiding or reducing impacts to resources are listed in Tables 4.7-1 and 5.7-1. No additional mitigation measures for cumulative effects are proposed.

7.8 CLIMATE CHANGE AND GLOBAL WARMING

This section is largely as presented in the 2010 Final EIS (Volume 7, Chapter 4: Cumulative Effects, Section 4.4: Climate Change and Global Warming, pages 4-87 to 4-94) but was updated with new information. The effect of greenhouse gases on climate change and global warming from the collective action alternatives and the associated regulatory framework remain the same as detailed in the 2010 Final EIS.

The 2010 Final EIS-predicted construction and operational greenhouse gas described in terms of total annual emissions from island-wide activities. As indicated by the air quality modeling results presented in Sections 4.1.3, 5.1.3, and 6.1 of this SEIS, and because of the overall reduced scale of construction and population change for the Marine Corps relocation under the 2012 Roadmap Adjustments, the operational greenhouse gas emissions for the SEIS proposed action would be lower than those analyzed in the 2010 Final EIS. Therefore, cumulative air quality impacts in terms of proposed construction and facility operations associated with this SEIS would be less than those described in the 2010 Final EIS.

The collective action alternatives discussed in this SEIS are unlikely to vary substantially in the quantity of CO_2e emissions. For example, the same amount of construction activities would occur regardless of the different locations (alternatives), resulting in essentially the same amount of greenhouse gas emissions. Therefore, the greenhouse gas emissions for the different alternatives would be similar to those of the collective action alternatives.

The change in climate conditions caused by greenhouse gas resulting from the burning of fossil fuels from the proposed alternatives is a global effect, and requires that the emissions be assessed on a global scale. The collective action alternatives mainly involve the relocation of the military operations that are already occurring in the West Pacific region; therefore, fossil fuel burning activities in the West Pacific region are unlikely to change significantly. Consequently, overall global greenhouse gas emissions are unlikely to change on a regional or global scale as a result of the collective action alternatives, resulting in an insignificant cumulative effect to global climate change. No potential specific greenhouse gas emission mitigation measures are proposed.

7.8.1 Climate Change Adaptation

Climate change is a global issue for DoD. As is outlined in the Quadrennial Defense Review of February 2010, DoD needs to adjust to the impacts of climate change in military facilities and military capabilities. The DoD already provides environmental stewardship at hundreds of DoD installations throughout the U.S. and around the world, working diligently to meet resource efficiency and sustainability goals as set by relevant laws and executive orders. Although the U.S. has significant capacity to adapt to climate change, it will pose challenges for civil society and DoD alike, particularly in light of the nation's extensive coastal infrastructure. In 2008, the National Intelligence Council judged that more than 30 U.S. military installations were already facing elevated levels of risk from rising sea levels. DoD's operational readiness hinges on continued access to land, air, and sea training and test space. Consequently, the DoD must complete a comprehensive assessment of all installations to assess the potential impacts of climate change on its missions and adapt as required.

The Quadrennial Defense Review goes on to illustrate that DoD will work to foster efforts to assess, adapt to, and mitigate the impacts of climate change. Domestically, the Department will leverage the Strategic Environmental Research and Development Program, a joint effort among DoD, the Department of Energy, and the USEPA, to develop climate change assessment tools. Abroad, the Department will increase its investment in the Defense Environmental International Cooperation

Program not only to promote cooperation on environmental security issues, but also to augment international adaptation efforts. The DON operational side published the *Task Force Climate Change Roadmap* on May 21, 2010, which builds off the Quadrennial Defense Review and focuses on the naval operational challenges of a changing climate. Although the document does not address compliance issues, the roadmap also recognizes the need to address sea level rise impacts on infrastructure and real estate through strategic investments and installation adaptation strategies to address water resource challenges.

Guam would have some unique adaptation issues to evaluate and consider. The U.S. Global Climate Research Program report, "Global Climate Change Impacts in the U.S." reviewed the unique impacts of Climate Change on Islands. According to the report, climate change presents U.S.-affiliated islands with unique challenges. Small and low elevation islands are vulnerable to sea-level rise, coastal erosion, extreme weather events, coral reef bleaching, ocean acidification, and contamination of freshwater resources with saltwater. The islands have experienced rising temperatures and sea level in recent decades. Projections for the rest of this century suggest continued increases in air and ocean surface temperatures in both the Pacific and Caribbean, an overall decrease in rainfall in the Caribbean, an increased frequency of heavy downpours nearly everywhere, and increased rainfall during the summer months (rather than the normal rainy season in the winter months) for the Pacific islands. Hurricane wind speeds and rainfall rates are likely to increase with continued warming. Island coasts would be at increased risk of inundation due to sea-level rise and storm surge with major implications for coastal communities, infrastructure, natural habitats, and resources.

7.8.1.1 Climate Change and Impacts on Waterfront Facilities

Until 1900, there was little change in sea level, but during the last century, sea level rose gradually and is currently rising at an increased rate. The average rate of sea level rise measured by tide gauges from 1961 to 2003 was 0.071 ± 0.02 inches (0.18 ± 0.05 c]) per year, with an annual increase of 0.12 ± 0.03 inch (0.31 ± 0.07 cm) seen between 1993 and 2003, and a total increase of 6.7 ± 2 inches (17 ± 5 cm) during the 20th century. This increase is due to thermal expansion (indicating increased heat content) and the exchange of water between oceans and other reservoirs (i.e., glaciers and ice). By the end of this century, sea level is predicted to rise 7-23 inches (18-59 cm), with an additional 4-8 inches (10-20 cm) rise possible due to the melting of land ice sheets in Greenland (Intergovernmental Panel on Climate Change 2007).

Projections made for Guam indicate that sea level rises of up to 39 inches (100 cm) would result in a few low lying areas of Apra Harbor being inundated. The DON acknowledges there is the potential for existing and future coastal facilities to be adversely affected by sea level rise, inundations from more extreme storm events, and other consequences of climate change. However, predictive models on future sea level rise are subject to variability, due in part to unknown future greenhouse gas emissions. The variability increases with the period of time being assessed. Risk assessment methodologies and technologies are being developed to predict the potential impacts of climate change on existing DON coastal facilities. As new design criteria relevant to climate change are adopted by the DON, they will be incorporated into project designs. Harbor projects on Guam are designed to include tsunami, typhoon, wind, and earthquake conditions.

The waterfront activities of the collective action alternatives are limited to the wharf improvements at Inner Apra Harbor. These improvements include repair and maintenance of existing wharves and construction of support facilities. The Inner Apra Harbor wharf improvements do not alter the original

wharf design; the elevations are not altered. As new design criteria are adopted by the DON, they will be incorporated into programmed projects.

7.8.1.2 Climate Change and Impacts on Aquifers

The availability of freshwater is likely to be reduced, with significant implications for island communities, economies, and resources. Most island communities in the Pacific and Caribbean have limited sources of freshwater. Many islands depend on surface water and freshwater lenses below the surface, which are recharged by precipitation. Changes in precipitation, like the anticipated increases in summer precipitation and the frequency of heavy rains, would increase on Guam. This would increase the potential to cause more frequent flooding, which could compromise the quality of water supplies. Sea-level rise also affects island water supplies by causing salt water to contaminate the freshwater lens and by causing an increased frequency of flooding due to storm high tides. Water pollution (such as from agriculture or sewage), exacerbated by storms and floods, can contaminate freshwater supplies, affecting public health.

The collective action alternatives, specifically the additional population, could have an additive cumulative effect with climate change impacts on aquifer yield. However, the USGS and WERI have recently developed a groundwater model for Guam that can be used to assist with the management of groundwater production from the NGLA (USGS 2013). The development of this groundwater model included consideration of different climate scenarios, including extended drought. The groundwater model will be used by the GWA and DoD and serve as a tool to assist in estimating the impacts of selected groundwater-pumping and climate scenarios on the water supply.

In addition, the USGS was recently awarded a study under a Strategic Environmental Research and Development Program grant from DoD. The 4-year study *Water Resources on Guam: Potential impacts and adaptive response to climate change for DoD Installations* would evaluate potential adverse climate-change impacts on DoD installations that rely on Guam's surface water and groundwater resources and identify the adaptive capacity to minimize the adverse impacts. Potable water demands are projected to increase and the effects of climate change may limit the water resources available to meet these demands. The study will address potential impacts of and adaptations to climate change with the following: (1) evaluation of the accuracy of the Coupled Model Intercomparison Project Phase 5 results and use of the best Coupled Model Intercomparison Project Phase 5 models to generate downscaled climate projections and to quantify changes in tropical cyclone activity; (2) update and expansion of an existing watershed model for southern Guam to evaluate climate driven changes in streamflow captured by Fena Valley Reservoir; (3) analysis of climate change induced modifications in sediment loads and turbidity of water entering Fena Valley Reservoir; (4) refinement of the hydrologic budget of northern Guam to estimate groundwater recharge for current and future conditions; (5) update of the existing numerical groundwater model to incorporate these recharge changes; and (6) establishment of rigorous stakeholder participation. The climate change driven impacts to existing infrastructure and the adaptive capacity to minimize the impacts will be evaluated by (1) showing temporal changes in surface water reservoir storage for climate change scenarios due to modified streamflow, estimating reduced (due to sedimentation) or increased (due to dredging or raised spillway) reservoir storage capacity, and estimating the frequency and volume of high-turbidity events; (2) quantifying changes in groundwater salinity from new recharge and sea-level estimates, and testing adaptive pumping and well design strategies for a range of climate scenarios and projected demand estimates; and (3) investigating the conjunctive use of surface water and groundwater to maximize DoD's potential for developing water resources.

7.8.1.3 Climate Change and Impacts on Coral Reefs

Climate change and ocean acidification have been identified as the greatest global threats to coral reefs, resulting in mass coral bleaching events, reduced coral growth rates, and potential increases in the frequency and severity of coral disease outbreaks. Coral are particularly sensitive to the impacts of climate change as even small increases in water temperature can cause coral bleaching. As concentrations of atmospheric CO_2 increase, more CO_2 is absorbed at the surface of water bodies. Elevated CO_2 concentrations are resulting in ocean acidification, which changes the chemistry of ocean water, including a decrease in the saturation state of calcium carbonate. Marine calcifiers, such as corals, use calcium carbonate to form shells, skeletons, and other protective structures and reduced availability of it can slow or even halt calcification rates in these organisms.

The collective action alternatives on Guam would increase the levels CO_2 generated on Guam (see Table 7.6-1) and contribute to the climate change impacts on the future health of corals and other marine resources on Guam. In addition to dredging (for the 2010 ROD-Related Actions), there are other potential impacts to marine resources associated with the collective action alternatives (i.e., increased marine recreational use) that would contribute to the cumulative effect; however, potential mitigation measures such as awareness training could offset these impacts to some degree.

7.8.1.4 Conclusions

The collective action alternatives would contribute to climate change. As climate science advances, the DON would regularly reevaluate climate change risks and develop policies and plans to manage any climate change impacts to DON's operating environment, missions, and facilities. As indicated in Section 7.8.1.2 in this SEIS, a 4-year study is being done that would evaluate potential adverse climate-change impacts on DoD installations that rely on Guam's surface water and groundwater resources and identify the adaptive capacity to minimize the adverse impacts. Managing the impacts of climate change on national security would require the DON to work collaboratively, through a whole-of-government approach with GovGuam.

CHAPTER 8
ADDITIONAL CONSIDERATIONS REQUIRED BY NEPA

8.1 INTRODUCTION

This chapter addresses additional considerations required by NEPA, which includes consistency with other federal, state, and local land use plans, policies, and controls; required permits and approvals; irreversible and irretrievable commitment of resources; the relationship between short-term use of the environment and long-term productivity; and sustainability and smart growth.

8.2 CONSISTENCY WITH OTHER FEDERAL, STATE, AND LOCAL LAND USE PLANS, POLICIES, AND CONTROLS

The proposed action alternatives as outlined in this SEIS have been developed to ensure consistency with land use guidelines for the project areas and with the objectives of federal, regional, state, and local land use plans, policies, and controls. The DON does not have zoning laws or codes, but there are ideal functional relationships among land uses that guide installation development. Naval Base Guam and AAFB have land use plans that currently guide land use planning for those installations. The Regional Commander, in consultation with base planners, would direct future development to be consistent with the objectives of the land use plan. Other relevant planning documents that would affect future development include Regional Shore Infrastructure Plans and UFC documents that provide planning, design, construction, sustainment, restoration, and modernization criteria. The proposed action alternatives discussed in this SEIS would follow these guidelines. In addition, these alternatives have been developed in consultation with base planners and approved by the Regional Commander; therefore, all of the proposed action components would also be in compliance with COMNAV Marianas Instruction 3500.4, *Marianas Training Handbook* (DoD 2000) and MCO P3550.10 (DON 2005).

AAFB identified a number of land use compatibility issues associated with the proposed NWF LFTRC; these are summarized in Table 8.2-1. The Army National Guard also identified potential impacts associated with Alternative D (cantonment and family housing at Barrigada) to include: delays in their ongoing processes to acquire additional acreage north or east of the existing Army National Guard compound; a potential reduction in access to training areas that the Army National Guard currently uses in the Barrigada area; and a potential for increased traffic impacts associated with the Army National Guard's plans for future development near their main entrance. The Territory of Guam Master Plan that was prepared for the Territorial Planning Commission in 1966 is the adopted land use plan for Guam. Other plans have been developed such as the 1978 Guam Comprehensive Development Plan (Bureau of Plan 1978) and 1994 *I Tano'-ta: The Land Use Plan for Guam* (Territorial Planning Council 1994). The 1978 Plan was valid for a planning period up to 2000. The *I Tano'-ta* was adopted in the Guam Land use and Zoning Law in 1999, but subsequently suspended and the 1966 zoning and zoning law is the prevailing regulation (Bureau of Statistics and Plans 2008). These plans provide valuable information on existing and planned land uses at points in time. The Bureau of Statistics and Plans recently prepared the *North and Central Guam Land Use Plan*. Although the plan was adopted, the associated changes to zoning codes are pending. The assumption is that the land use plan represents the general direction of GovGuam and the community with respect to guiding future land use development in the central and northern areas of Guam. There are no such plans for the southern portion of Guam. It is also likely that rezoning of property in the surrounding community would occur in response to DoD development. The

North and Central Plan guides development decisions generally but refinement or more precise expression of land use occurs through Guam Land Use Commission actions that may or may not follow the general plan. The DoD has no direct control or authority over this process except to attempt to mitigate effects of incompatible land uses near installations. Additionally, the DoD assists communities to plan for "outside the fence" land use and economic impact through the OEA.

Table 8.2-1. NWF LFTRC Land Use Compatibility Concerns

Concern	*Impacts to Air Force Mission*	*Proposed Resolution*	*Status*
HG Range	Concern with potential noise impacts to other training at PRTC	HG Range relocated to Andersen South.	Resolved
Joint Threat Emitter	Joint Threat Emitter is critical for ATCAA 3. SDZ conflict in earlier LFTRC versions would affect Joint Threat Emitter availability	LFTRC layout modified to remove Joint Threat Emitter from SDZ footprint.	Resolved. Resolution of noise impacts to Joint Threat Emitter equipment is pending.
EOD Operations	RED HORSE EOD conducts controlled training detonations	Deconflict through range scheduling/range control. Utilize Tarague EOD area.	Pending development of Memorandum of Agreement
Contingency Response Group Operations	LFTRC would limit availability of Fortress Drop Zone and assault strip operations for required Air Force training.	Due to relatively low frequency, scheduling is primary means of deconfliction with LFTRC; alternate SDZs and aviation safety zones exist, if required.	Pending development of Memorandum of Agreement
VFR Recovery Point	Restricted area required for LFTRC conflicts with "North Point" VFR recovery point	TBD	Pending Memorandum of Agreement development
TERPS Issues	LFTRC impacts holding altitudes with associated published Installation Insurance Plans and circling approaches to the north	TBD	Pending Memorandum of Agreement development

8.3 REQUIRED PERMITS AND APPROVALS

A list of federal and local permits that may be required for implementation of any of the alternatives is provided in Table 3.1-1 of the 2010 Final EIS (Volume 8, Chapter 3: Required Permits and Approvals, pages 3-1 through 3-5). Permits and approvals for the proposed action are expected to be the same as for the 2010 Final EIS for the NEPA EIS review as well as project design, construction, and operation phases. While some regulations require permits, many serve only as guidance. DoD-proposed actions would be implemented in accordance with all applicable regulatory mandates.

Federal regulations that are or may be applicable to the proposed action include, but are not limited to:

- Archeological and Historic Resources Preservation Act
- ARPA
- CAA
- CWA
- Coastal Zone Management Act
- Comprehensive Environmental Response, Compensation, and Liability Act
- Department of Transportation Regulations
- National Wildlife Refuge System Administration Act
- Migratory Bird Treaty Act
- NHPA
- Noise Control Act
- Oil Pollution Act
- OSHA
- Pollution Prevention Act
- Resource Conservation and Recovery Act

- Emergency Planning and Community Right-to-Know Act
- ESA
- Federal Environmental Pesticide Control Act
- Federal Facilities Compliance Act
- Federal Insecticide, Fungicide, and Rodenticide Act
- Fish and Wildlife Coordination Act
- Groundwater Rule
- Marine Protection, Research, and Sanctuaries Act
- Fish and Wildlife Coordination Act
- Groundwater Rule
- Marine Protection, Research, and Sanctuaries Act
- Military Munitions Rule under Resource Conservation and Recovery Act
- Rivers and Harbors Act
- Safe Drinking Water Act
- Ship-Borne Hazardous Substances Regulations
- Statement of Procedures on Floodplain Management and Wetlands Protection
- Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks
- Toxic Substances Control Act
- Underground Storage Tanks

Guam regulations that are or may be applicable to the proposed action include, but are not limited to:

- Guam Coastal Nonpoint Pollution Control Program
- Guam Air Pollution Control Standards and Regulations
- Guam Environmental Protection Act
- Guam Hazardous Waste Management Program
- Guam Primary Drinking Water Regulations
- Guam Seashore Protection Act and Permit System
- Guam Soil Erosion and Sedimentation Control Regulations/Permits
- Guam Water Quality Standards
- Test Boring and Dewatering Permit
- Guam CWA Section 401 Water Quality Certification
- Guam Water Resources Development and Operating Regulations

8.4 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA § 101 2(c)(iv) requires a detailed statement on any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented. Irreversible and irretrievable resource commitments are related to the use of non-renewable resources and the effects that the use of those resources have on future generations. Irreversible commitments of resources are those that cannot be reversed except over an extremely long period of time. These irreversible effects primarily result from destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable timeframe. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species or the disturbance of a cultural site).

The proposed action would constitute an irreversible or irretrievable commitment of non-renewable or depletable resources, for the materials, time, money, and energy expended during activities required for implementing the proposed action. Irreversible and irretrievable commitments of resources would occur under all alternatives. Particular irreversible and/or irretrievable impacts that would result are noted below. These impacts are similar to those described in the 2010 Final EIS (Volume 8, Chapter 4, Irreversible and Irretrievable Commitment of Resources, pages 4-1 through 4-2).

Irreversible and irretrievable commitment of resources related to the construction and operation of the proposed cantonment/family housing includes consumption of fossil fuels and energy for construction equipment, materials for construction of new facilities and associated private-sector economic and population growth, and physically altering land with construction and committing land associated with the project to a new use for the foreseeable future. Construction and operation of the proposed LFTRC would result in an irreversible and irretrievable commitment of fossil fuels and materials as well as a commitment of land and airspace for training activities associated with LFTRC operations.

Materials and energy consumed for the project represents a permanent and non-renewable commitment of these resources. Construction and maintenance activities are considered a long-term, non-renewable investment of these resources. Land that would be physically altered by construction would be committed to the new use for the foreseeable future, and would represent a permanent commitment of the land for the life of the project to a developed use, decreasing the amount of open land available for other uses. Access to the developed lands would be limited to authorized personnel.

Compared to the 2010 Final EIS, the proposed action addressed in this SEIS comprises a smaller Marine Corps cantonment/family housing area, a similarly-sized LFTRC that has a smaller SDZ footprint (based on the SDZ reduction achieved by applying the probabilistic methodology to the MPMG range), and reduced-scale infrastructure requirements to support a reduced number of relocating Marines and dependents than originally planned. Therefore, there would be a reduction in the irreversible and irretrievable commitment of resources based on the proposed action described in this SEIS compared to the 2010 Final EIS, primarily with respect to the cantonment/family housing area and reduced-scale infrastructure requirements.

Under the No-Action Alternative, the DON would implement projects identified in the September 2010 ROD (see Section 2.1 of this SEIS). The decision to construct and operate the LFTRC would remain deferred, and the DON would establish a cantonment/family housing area for approximately 8,600 Marines and 9,000 dependents on federally controlled lands at Finegayan and South Finegayan and by acquiring land known as the former FAA parcel. Therefore, under the No-Action Alternative there would also be irreversible and irretrievable commitments of resources. Irreversible and irretrievable commitments of resources as described in the 2010 Final EIS (Volume 8, Chapter 4: Irreversible and Irretrievable Commitment of Resources, pages 4-1 through 4-2) would be the same, although there would be slightly less commitment of land resources and consumption of fossil fuels and energy for construction and operation of the LFTRC.

8.5 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Section 102(2)(C)(iv) of NEPA requires an analysis of the relationship between a project's short-term impacts on the environment and of the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment (i.e., ability to obtain or generate desired goods, services, or benefits in the future). Impacts that narrow the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing one development option reduces future flexibility in pursuing other options, or that designating a parcel of land or other resource for a certain use eliminates the possibility of other uses being performed at the site.

Short-term uses of the environment associated with the proposed action include changes to the physical environment and energy and utility use during the construction of facilities associated with all alternatives. Construction would involve short-term increases in fugitive emissions and construction-

generated noise and would increase the use of fossil fuels to provide power to equipment. In addition, expenditures of public funds and the use of labor would be required.

Long-term changes would include alterations to land use on Guam that would exist for the life of the new facilities. For the purposes of this section, the "lifespan" of the proposed action is undefined but would end whenever the use of the proposed cantonment, LFTRC, and/or family housing areas are no longer needed by the DoD.

There are numerous BMPs, plans, procedures, protocols, regulations, and laws that have been established to protect human health and the environment. Compliance with regulatory mandates, permit conditions and protective measures by the DoD and its contractors would reduce both short-term and long-term impacts. In addition, by minimizing these impacts, the relationship between short-term use of the environment and long-term productivity would not be adversely affected because the range of options for future beneficial uses would not be diminished, allowing for more flexibility in long-term use options.

8.5.1 Geological and Soil Resources

Construction of the proposed action would require cut and fill, grading and contouring with long-term changes to topography. These alterations would persist beyond the life of the project. Future land uses could restore the topography - if warranted.

There would be a larger area of the island where soil is disturbed from its natural condition and identified as Urban Land Complex due to the proposed action. Slope stability would not be altered. Engineering controls implemented during project design and construction, as well as stormwater control measures implemented during operations, would control drainage and runoff and minimize the risk of soil erosion. The potential for erosion due to live-fire range activities would be minimized through range maintenance and management activities.

For any sinkholes discovered before or during construction, BMPs would include compliance with the requirements of 22 GAR Chapter 10 § 10106F; therefore, the proposed action would not result in significant impacts to sinkholes. The proposed action would not increase the risk associated with earthquakes, fault rupture, slope instability, tsunamis and liquefaction.

Use of geology and soils for implementation of the proposed action would not reduce the range of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.5.2 Water Resources

There would be an increase in the amount of impervious surface resulting from implementation of the proposed action. With the application of BMPs, LID, sustainable measures, and compliance with federal and GovGuam guidelines, water quality on Guam would be protected from impacts resulting from the proposed action. Long-term beneficial impacts to nearshore water quality would occur through mitigation by assisting the GWA in identifying funding from federal agencies to upgrade the Northern District WWTP.

The potential for leachate from MECs affecting surface water or groundwater would be minimized through range maintenance BMPs and management activities.

The proposed action would not increase the risk of flood hazards and would result in either no impacts to wetlands or less than significant impacts to wetlands through mitigation, depending upon the alternatives selected.

The proposed action would not reduce the range of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.5.3 Air Quality

Construction and operational air quality impacts associated with the proposed action would not exceed significance thresholds.

Administration, maintenance, housing, and quality of life operations would receive power from existing stationary utility sources and include installations of various emergency generators on Navy and other critical DoD/Marine Corps facilities. However, the affected existing stationary utility sources would be operated below their currently permitted capacity under the proposed action. Therefore, operating these affected existing power sources would be in compliance with the applicable NAAQS, resulting in a less than significant impact. For anticipated installations of emergency generators at critical DoD facilities, if required under the CAA and/or GEPA permit regulations, applicable existing facility air permits would be modified or new air permits would be obtained at new facilities during the design phase of the project. This would ensure that these new emergency generators would be operated in compliance with applicable air regulations, resulting in a less than significant impact.

Stationary source air emissions due to the proposed action are not expected to violate air quality regulations designed to protect human health and the environment, and therefore would not degrade the long-term productivity of the ambient air environment. The proposed action would not reduce the range of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.5.4 Noise

Construction and operational noise impacts associated with the proposed action would not exceed impact assessment criteria thresholds. There are no sensitive receptors that would be within the Zone II contour for the LFTRC. The steady-state noise generating activities at Finegayan would be primarily due to traffic and the impact would be less than significant.

Noise generated by the proposed action would cease at the end of the life of the project with no long-term impacts on ambient noise levels. The proposed action would not reduce the range of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.5.5 Airspace

The proposed action, specifically the LFTRC, would have the potential for significant impacts to aviation. The potential impacts associated with the proposed action would be further studied through the DON, Air Force, and FAA consultation process and measures would be identified through this consultation process to minimize the potential effects. In addition, impacts to airspace generated by the operation of the proposed action would not permanently alter the airspace. FAA could revisit relevant airspace parameters and designations and restore the airspace to existing conditions at the end of the life of the proposed action. The proposed action would not reduce the range of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.5.6 Land and Submerged Land Use

There are federal and GovGuam submerged lands that would be impacted by the LFTRC SDZs. The LFTRCs would result in new public access restrictions for health and safety reasons. At the end of the

lifespan of the proposed action, the public access restrictions could be removed for a beneficial impact on long-term use of the submerged lands.

The proposed action would change the current land uses of existing federal lands, and prior to implementation of the proposed action, any on-base land use compatibility issues will have been resolved. NWR land, currently managed by USFWS for conservation and education, would be within the LFTRC SDZs. USFWS administrative and visitor facilities would be relocated to the remaining area of the NWR. Public access would be restricted to portions of the NWR that overlap with the SDZs. The USFWS mission would be able to adapt to coexist with the change in land use and access restrictions. At the end of the lifespan of the proposed action, the access restrictions could be removed.

The short-term use of the land would have adverse impacts, but most of the impacts could be reversed to current conditions at the end of the lifespan of the proposed action. Current land use and access could be restored with no long-term loss of productivity and no impact on the range of options for future beneficial uses.

Land use changes outside the military installation would likely result from the economic growth associated with the additional population, potential development and activities that are created by the increased short-term spending associated with the proposed action, and over the longer term due to a more productive use of land than is taking place at present. This is similar to the induced growth that may be created as a consequence of improvements, particularly expansions, in transportation or other infrastructure that makes land more accessible and so increases the likelihood that this land would be developed or redeveloped. This land development and activities associated with induced growth could then contribute to both beneficial and adverse impacts on land use. Non-DoD land use development is subject to GovGuam agency approvals. The approval process considers the development proposal's consistency with established land use planning objectives and would minimize the adverse impacts of new development on land use.

8.5.7 Recreational Resources

The proposed action would result in adverse impacts to marine and terrestrial recreational uses at South Finegayan, and within the land and submerged land affected by the LFTRC. At the end of the life of the proposed action, these uses could be resumed. There is a potential that the restricted or managed recreational use during the life of the proposed action could beneficially impact recreational resource health. There would be a beneficial impact under the restricted access imposed by the LFTRC SDZs extending over ocean bottom fisheries areas. Short- and long-term beneficial impacts to recreation would occur from a healthier fishery by increasing fish landings when the range is not in use and when the range no longer exists.

The increase in island population (direct, indirect, and induced) could result in the overuse of existing recreational resources in other island locations. Foreseeable impacts include inadequate or overcrowded facilities, such as parking, picnic shelters, restrooms, showers, boat mooring facilities, etc. Moreover, a decreased sense of enjoyment due to increased competition for opportunities among users would result at most recreational facilities (e.g., more people on trails, crowding at popular dive spots). An increase in the number of users would accelerate the deterioration of existing facilities. Furthermore, over the long-term, recreational resources would see a reduction in productivity due to increased use from population growth from both military relocation and from organic growth, unless these resources are properly maintained.

There would be long-term impacts on recreational resource productivity. Depending on the extent of the impact to recreational resource health, it is possible for the resources to recover at some point in the future

after the lifespan of the proposed action has ended, and the range of options for future beneficial uses would be less than significantly affected.

8.5.8 Terrestrial Biological Resources

With implementation of the proposed action, large areas of primary and secondary native limestone forest would be removed, primarily associated with Overlay Refuge lands. Development of this limestone forest habitat within Overlay Refuge lands would represent a significant loss of recovery habitat for ESA-listed species including Mariana fruit bat, Mariana crow, Guam rail, Guam Micronesian kingfisher, and *Serianthes* tree.

Operational impacts would include noise, lighting, and other disturbance impacts on special-status species. Other long-term impacts could reduce habitat quality, such as the increased potential for fire and spread of non-native species. These would be balanced by the application of plans and procedures for wildland fire control and biosecurity, native forest enhancement, and by enlarging or creating new ERAs. Implementation of these plans would improve the overall quality of targeted habitat over current conditions by implementing ungulate management, control of invasive species, rodent and cat control, and restoration of native forests.

Potential effects on the Ritidian Unit of the Guam NWR and restricted access to lands within the SDZs could result in reduced access for monitoring, inventory surveys, habitat enhancement and restoration, and outreach activities.

The impacts of construction and operational activities of the proposed action would result in a loss of long-term productivity of terrestrial biological resources by limiting the range of future beneficial uses for these resources.

8.5.9 Marine Biological Resources

No in-water construction work is proposed for implementation of the proposed action. With the application of BMPs and LID plans, direct impacts on marine biological resources are expected to be less than significant. Reduced public access to submerged lands associated with the LFTRC SDZs would have a beneficial impact on marine biological resources.

The infrequency of bullets reaching the ocean and the reduced speed of the ricochet would result in less than significant direct impacts to marine animals within the SDZ. There would be long-term localized accumulation of small arms (no explosives) expended materials in the benthic habitat from the firing range operations. The rapid sinking rate of such munitions is expected to preclude ingestion by marine organisms. The operational impact of the LFTRC on marine resources would be less than significant, and no loss of long-term productivity for marine biological resources is expected. The proposed action would not reduce the range of options for future beneficial uses.

A beneficial impact on bottom fisheries would potentially occur due to restricted access under the Alternative 5 SDZ at NWF, thereby leading to a healthier fishery with increased fish yields when the range is not in use.

8.5.10 Cultural Resources

The proposed action would result in the direct loss and disturbance of NRHP-eligible sites. The potential for direct effects within the SDZ would be limited to the risk of strikes from stray rounds during range operations. The risk of such effects occurring is extremely low. The range would be designed to contain live fire inside the range itself to minimize the probability of rounds landing in the SDZ. Additionally, if a

stray round were to escape the range, the chance of it hitting a historic property is remote, given the size of the SDZ, natural topography, and dispersal of historic properties. For these reasons, the potential for direct adverse effects as a result of range operations is *de minimis*. There is potential for inadvertent or accidental damage to at least one NRHP-eligible site due to an increase in population in the area. The removal of limestone forest where culturally important natural resources may be located would also be required. With implementation of the processes and procedures in the 2011 PA, including data recovery, cultural awareness orientation briefs, and additional identification efforts, there would be a long-term benefit from the increase in knowledge of the past and the distribution of this knowledge to the public. However, at the end of the lifespan of the proposed action, the long-term productivity of cultural resources could be diminished, and the range of options for future beneficial uses may be affected.

8.5.11 Visual Resources

The proposed action would not substantially alter the views or scenic quality of significant and/or publicly recognized vistas, viewsheds, overlooks, or features; change the light, glare, or shadows within a given area; or affect sensitive receptors. At the end of the lifespan of the proposed action, facilities could be demolished and the built landscape altered. There would be no long-term loss of visual resource productivity, and the proposed action would not reduce the range of options for future beneficial uses.

8.5.12 Ground Transportation

There would be short-term adverse impacts on traffic associated with the proposed action and off-base roadway improvements are proposed that would benefit the civilian community. This benefit would extend beyond the life of the proposed action, for a positive long-term impact on ground transportation. The proposed action would not reduce the range of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.5.13 Marine Transportation

The proposed action may affect marine transportation by impacting the military, commercial, and recreational navigational usage of Apra Harbor through the increased number of vessels. The impact was determined to be less than significant.

The LFTRC SDZ impacts a designated shipping lane used by all vessels traveling from Hawaii to Guam; however, this is considered a less than significant impact. The LFTRC SDZ would affect recreational and commercial tour navigation between Hagåtña Marina and areas north and east of Guam. The impact to navigation is considered less than significant because vessels can transit around the SDZ and through the SDZ when the range is not in operation.

At the end of the lifespan of the proposed action, the impacts of the proposed action would cease and there would be no long-term impacts on marine transportation capabilities. The proposed action would not reduce the range of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.5.14 Utilities

Electrical power, potable water, and wastewater utility upgrades are required to support the proposed action. Some of the improvements to the GovGuam systems would benefit the community. This benefit would extend beyond the life of the proposed action, for a long-term positive impact on utility infrastructure. In addition, adding a substantial and reliable customer for wastewater, electrical power, and solid waste disposal services would provide GovGuam with needed long-term revenue to fund additional future upgrades to their utility infrastructure. The proposed action would not reduce the range

of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.5.15 Socioeconomics and General Services

Beneficial impacts, adverse impacts, and significant impacts of a mixed nature are identified for the proposed action; however, the generalized conclusion for Population Change, Economic Activity, Public Services, and Sociocultural Issues categories is that there would not be major adverse changes to Guam's existing socioeconomic infrastructure. The population change associated with the proposed action would not likely put excessive strain on most of Guam's public services agencies, and the estimated increases in GovGuam tax revenues would likely compensate for any increased demand that would occur. The economic impacts would be beneficial, leading to increased employment and standards of living, and impacts to Guam's housing stock and availability would not bring about reactionary development, which could have otherwise lead to dislocations in the housing market. Impacts to GovGuam public services are identified; impacts to some public service agencies are considered significant. These impacts are related to additional staffing required to meet demands from additional population that would be associated with the proposed action.

Once implementation of the proposed action is completed, the population would be reduced, with no long-term loss to the socioeconomic infrastructure. The proposed action would not reduce the range of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.5.16 Hazardous Materials and Waste

The proposed action would result in the increased transportation, handling, use, and disposal of hazardous materials (e.g., POLs/fuels) and hazardous wastes (pesticides, herbicides, solvents, lubricants, heavy metals). However, through the use of various BMPs and SOPs, operational impacts would be minimal. At the end of the lifespan of the proposed action, there would be a net increase in the use, generation and disposal of hazardous materials and waste over current baseline conditions; however, continued adherence to BMPs and SOPs with regards to their management and continued efforts to minimize the use and generation of hazardous materials and waste during operations would reduce potential adverse impacts to less than significant. The proposed action would not reduce the range of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.5.17 Public Health and Safety

The proposed action would result in an increased on-island population; however, no significant long-term risks to health, safety, or the general welfare of the public were identified.

At the end of the lifespan of the proposed action, there would be no residual impact to public health and safety. The proposed action would not reduce the range of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.5.18 Environmental Justice and the Protection of Children

Environmental justice examines the potential for adverse impacts to disproportionately affect socially disadvantaged groups, including racial minorities, low-income populations, and children. There likely would be disproportionate significant public health services effects on low-income populations. Guam's public health services would not be able to handle potential increases in illnesses of the medically underserved and low income at the current levels of staffing. Access to public health and social services would be additionally strained by an increase in uninsured and underinsured workers coming to Guam.

At the end of the lifespan of the proposed action, there would be no residual long-term impact to public health and safety. The proposed action would not reduce the range of options for future beneficial uses and less than significant impacts to long-term productivity are expected.

8.6 SUSTAINABILITY AND SMART GROWTH

DoD policy is to address sustainability concepts in acquisition and procurement processes and in planning and managing its installations. For every DoD program, the Department actively seeks opportunities to continually improve its activities, and continues to develop and improve methodologies to ensure systematic analysis, informed decision-making, and appropriate budgets to address sustainability in accordance with the 2012 DoD Strategic Sustainability Performance Plan. Marine Corps policy on sustainability, presented in the 2011 U.S. Marine Corps Sustainability Plan, aligns with the priorities, direction, and scope of the DoD Strategic Sustainability Performance Plan.

DoD has implemented sustainability measures on Guam, such as solar photovoltaic arrays and solar water heating. Ongoing energy efficiency efforts include smart metering and controls (building and utility control systems, peak load monitoring, etc.), solar street lights and parking/playground lighting, low flow fixtures, and new and retrofitted buildings to LEED Silver (or equivalent) design standards.

The 2010 Final EIS (Volume 8, Chapter 6, Sustainability and Smart Growth) provides a summary of sustainability goals, including an overview (laws, regulations and guidance, and the DON's energy policy), implementation strategies, and anticipated results (e.g., reductions in water use, energy use, greenhouse gas emissions, vehicle miles traveled, and plans to implement renewable energy). Those sustainability goals and potential strategies were identified based on studies conducted for the 2010 Final EIS. The studies were shaped by smart growth and sustainability workshops for DoD stakeholders to identify specific elements to be included in the concept plan for the proposed action, with a primary focus on the preferred cantonment/family housing area in the 2010 Final EIS.

The DON conducted a new sustainability analysis for the 2012 Roadmap Adjustments SEIS. The new analysis addressed the smaller force, reduction in size of the cantonment and family housing areas, and locations of the cantonment and family housing alternatives. The study identified strategies for each primary system - water, energy (building, district, renewable and public realm), green building/ LEED and transportation. Plans for each primary system were adjusted to achieve environmental benefit in a cost-effective manner. Identified strategies will be incorporated, as appropriate, into the design and implementation phases to support meeting federal sustainability mandates.

For the proposed action, DoD has identified potential sustainability strategies and measures to meet federal mandates and to achieve the following target goals set for 2020: 30% energy use reduction, 26% water use reduction, 30% reduction of petroleum use in fleet vehicles, 18.3% of total energy from renewable sources, 34% reduction in greenhouse gas emissions, and diversion of 50% of non-hazardous solid waste and 60% of construction and demolition debris from the waste stream. DoD's goal is to meet federal sustainability mandates for the new Marine Corps installation on Guam. The Marine Corps has developed goals in their 2011 Sustainability Plan to meet these mandates: Goal 1 - Improve energy and water resources management and reduce greenhouse gases; Goal 2 - Minimize waste and prevent pollution; and Goal 3 - Improve integration of sustainability practices across all missions areas.

High Performance and Sustainable Building Requirements (UFC 1-200-02) the U.S. Green Building Council LEED Reference Guide for Green Building Design and Construction, and LEED New Construction Rating System are included in the DON's design and construction contracts to meet federal

sustainability mandates. The Guiding Principles for Sustainable New Construction and Major Renovation provides guidance on employing integrated design principles, optimizing energy performance, protecting and conserving water, enhancing indoor environmental quality, and reducing environmental impact of materials. For new construction, reduction of energy and water usage is compared to the baseline building performance per established performance standards and requirements. Sustainability strategies for building energy reduction, renewable energy opportunities, water conservation measures, greenhouse gas reduction, and waste reduction are summarized below. Based on these strategies, the new Marine Corps installation on Guam will strive to meet sustainability mandates and DoD goals, including the net-zero energy installation goal (an installation that produces as much energy on site as it uses, over the course of a year).

8.6.1 Energy Reduction

The sustainability strategy for energy reduction is to implement energy conservation measures on appropriate buildings under the proposed action. These include: building control systems for lighting, light emitting diode exterior lighting, highly efficient windows, thermal insulation, more efficient fans and pumps, other technologies to reduce the cooling load of buildings, and the use of energy star appliances. In addition, industrial control systems, advanced meters, utility and building control systems, industrial control systems infrastructure (hardware, software, communication pathways), smart meters, direct digital control, and other Smart Grid components would be implemented to provide power, to allow monitoring and control systems for more efficient energy usage and to enable energy management.

8.6.2 Renewable Energy

On-site renewable energy would be provided when lifecycle cost is cost-effective and technically feasible in accordance with DoD guidance. For the proposed Marine Corps installation on Guam, combined building-mounted renewables and/or ground-mounted solar photovoltaic arrays are being considered and will be installed based on results of the feasibility study that the DON is currently conducting to determine if rooftop, adhered photovoltaic systems are economically viable and capable of withstanding typhoon conditions in Guam's corrosive environment. The proposed Marine Corps installation would partner with JRM to achieve renewable energy mandates through either an installation or regional approach using large-scale solar photovoltaic, wind, and/or other renewable resources. A portion of the power demand would be satisfied by power generated from renewable energy sources, to include photovoltaic solar panels on rooftops and approximately 20 acres (8 ha) within the cantonment and/or family housing footprints proposed for ground-mounted photovoltaic panels. JRM has initiated a regional approach to achieve renewable/alternative energy goals and would cooperate with GPA to further develop the island-wide energy demand side management and energy efficiency via renewable energy project(s) on DON-controlled land (DON 2014).

8.6.3 Water Conservation Measures

DoD would implement water conservation measures to meet indoor water use reduction mandates. Water conservation measures include low-flow water fixtures and dual flush toilets. Other potential strategies may include rain water harvesting, condensate collection from heating, ventilation, and air conditioning units and grey water collection in cisterns for additional water supply. Outdoor water conservation measures are also being considered such as reduction or elimination of irrigation systems, and use of native plants for landscaping.

8.6.4 Transportation

Potential strategies to reduce vehicle miles traveled and greenhouse gas emissions include the following:

- Use of more fuel-efficient or alternative-fuel vehicles with a fuel efficiency of at least 28.7 mpg (12.2 km/liter) or higher.
- Reduction in the number of employee commuting vehicle trips through carpooling incentives, and live-where-you work community design.
- Consider establishing a shuttle bus system to reduce traffic and improve circulation if deemed necessary.
- Design a transportation network with special consideration for pedestrians and bicyclists.
- Use of mass transit by UDP (rotational) personnel instead of privately-owned vehicles.
- Selection of the cantonment/family housing and LFTRC alternatives combination that would result in reduced travel distances.

8.6.5 Waste

The waste reduction mandates would be met through implementation of the following strategies:

- Maintenance and expansion of installation or regional recycling programs throughout the proposed Marine Corps cantonment/family housing.
- Construction of new recycling and transfer facilities at the proposed cantonment/family housing.
- Adequate laydown and processing areas in contract specifications to allow diversion of green waste (including composting), concrete, and asphalt rubble from landfill disposal.
- Requirement in the contract specifications to meet federal mandates for waste diversion during construction, including submittal of a waste management plan and reporting of waste diversion.

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CHAPTER 9
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